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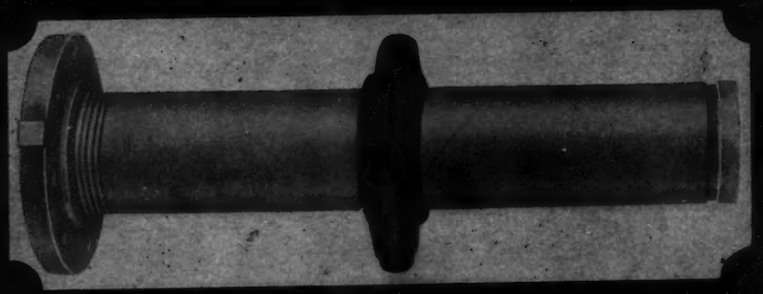

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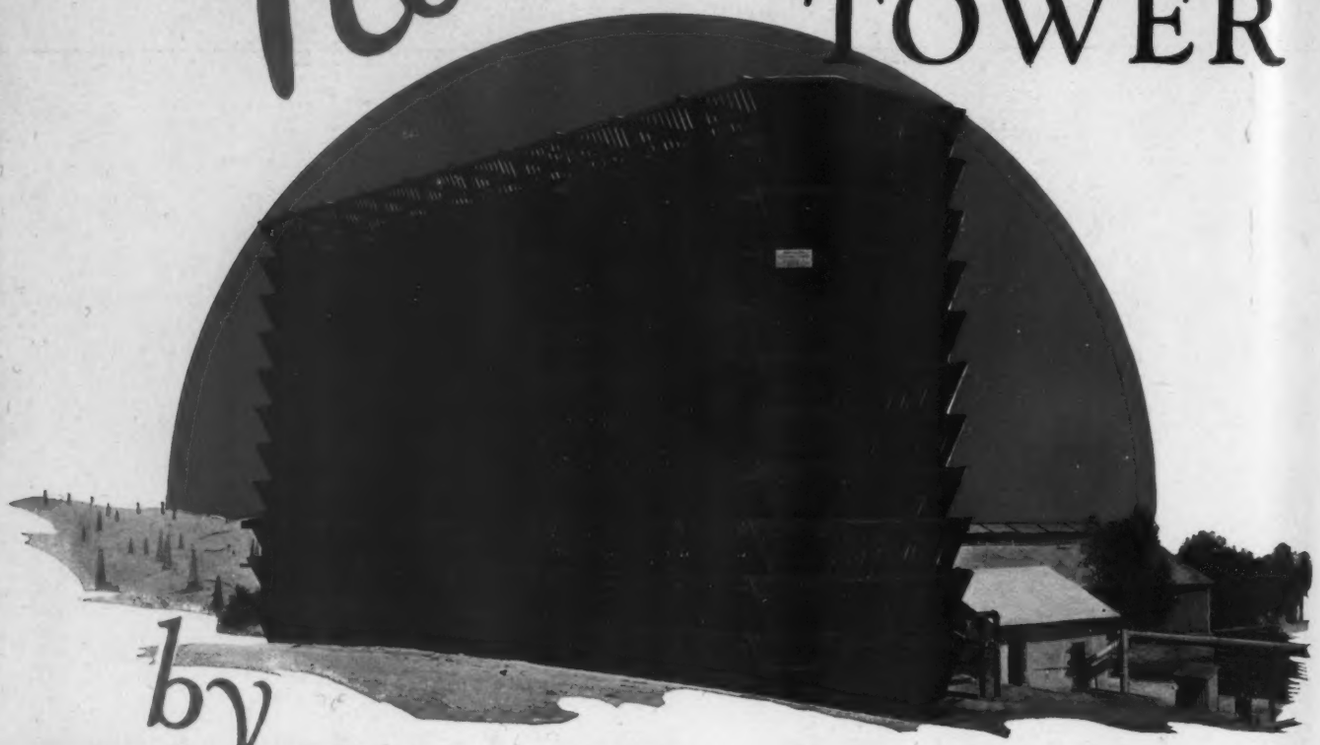

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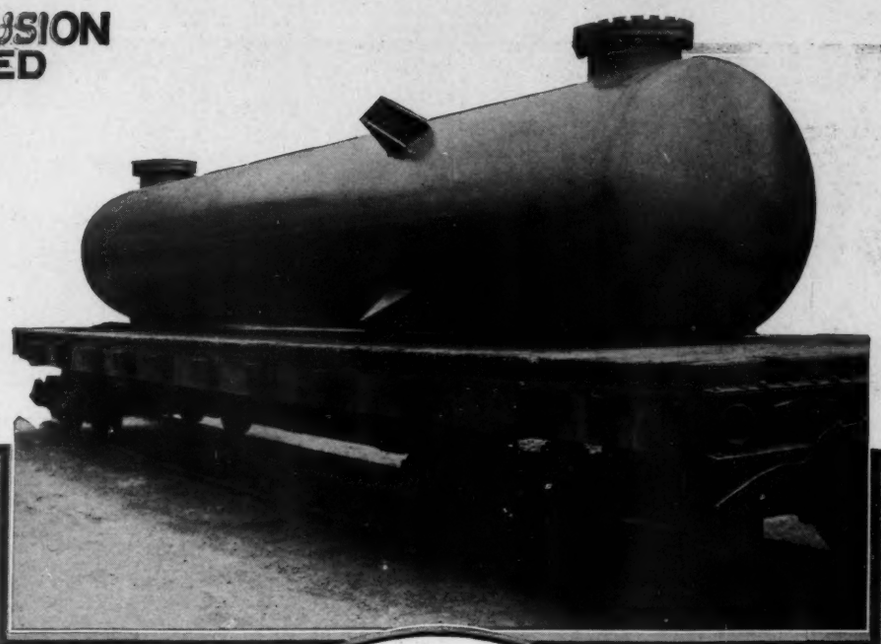

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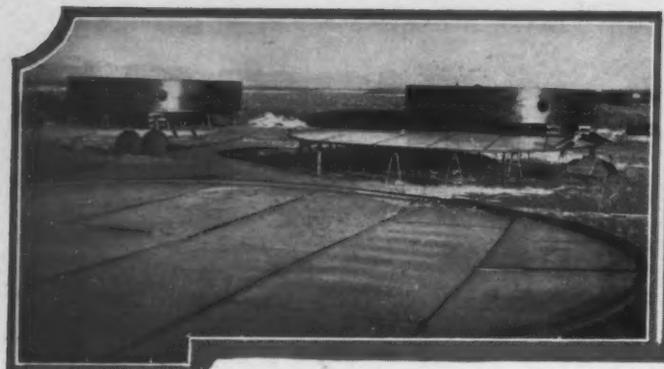

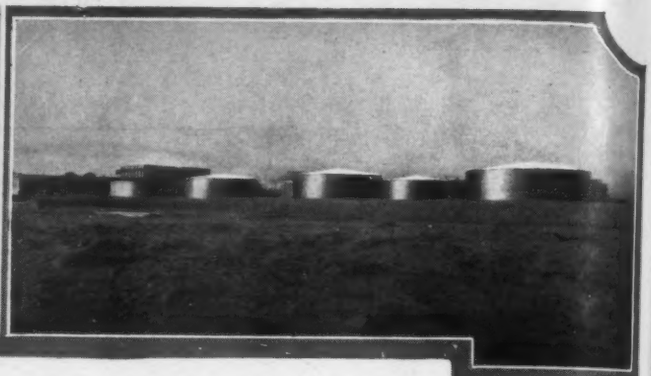

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The REFINER

AND NATURAL GASOLINE MANUFACTURER

Edited Monthly at Tulsa, Oklahoma

GRADY TRIPLETT, *Editor* GEORGE REID, *Associate Editor*

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Broaden the Vision

FOR all of its progress, petroleum refining still lacks vision. To the refiner, crude oil is a source of only gasoline, kerosene and fuel oil. He wants these and any other products come in the role of a bother.

This condition, which is a matter of attitude, has particular application to the great West Texas area. The fear that existed when this district offered its first crude oil has been overcome, for refining plants are dotting the section. But the attitude toward West Texas oil is this—the oil is a troublesome product, which can be handled with difficulty. In that the refining industry is after its common products.

These products must be taken from West Texas crude oil. Economic conditions demand that.

Where the attitude of the refiner needs revision is in regard to other substances in this crude oil. As long as foreign substances are removed from West Texas crude as bothersome, expensive processes, these substances will never have value.

When sulphur compounds and other substances, common to these crudes, come to be accepted as having possible value, the refining industry will have a desirable attitude toward these oils. It is possible that these bothersome chemicals may come to have value equal to, or even more than any petroleum product new being refined there.

Possibilities of that rich oil area are greater than oil. West Texas has rich deposits of potash and other chemicals. If that rich chemical area were a part of the German nation, it would be under the scrutiny of hundreds of chemists. Laboratories would be devoted to a study of the possibilities of these chemicals.

With its potash and other chemicals, West Texas holds possibilities of furnishing sufficient commercial fertilizer to remake an empire from agricultural standpoint.

The manufacture and sale of commercial fertilizer is perhaps beyond the scope of the petroleum industry. But the technical division of the industry is negligent when it does not consider this as having a bearing on its own problems. In making this fertilizer, the petroleum industry may find a profitable outlet for some of its present obnoxious substances in this crude oil.

From the executive viewpoint, the petroleum industry should be aggressive in seeking relation with other industries, which can convert the rich chemical deposits of this area into marketable products.

West Texas crudes demand the solution of many problems. But their solution should not be a closed incident when chemists and engineers have found methods of overcoming these problems. After that, there is need for finding use and markets for these chemicals.

NEWS dispatches recently gave the result of a successful test of a Diesel type airplane motor. The engine, a product of the Packard Motor Company, was classed as a success.

Use of the Diesel engine for the airplane and the automobile may never molest the refining branch of the petroleum industry. But if this type of engine can be built small enough to propel these vehicles of travel, there is a threat which the petroleum industry must not ignore.

While the petroleum industry is bent on manufacturing fuels for motors of higher compression, the motor industry may turn to the building of motors for fuels of lower compression.

The refining industry can furnish either. It should keep itself advised on which to prepare.

Grady Tribbett

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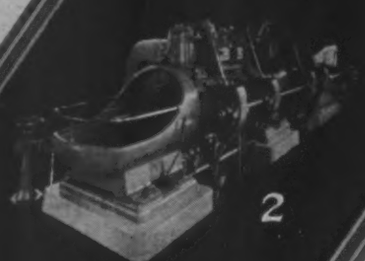

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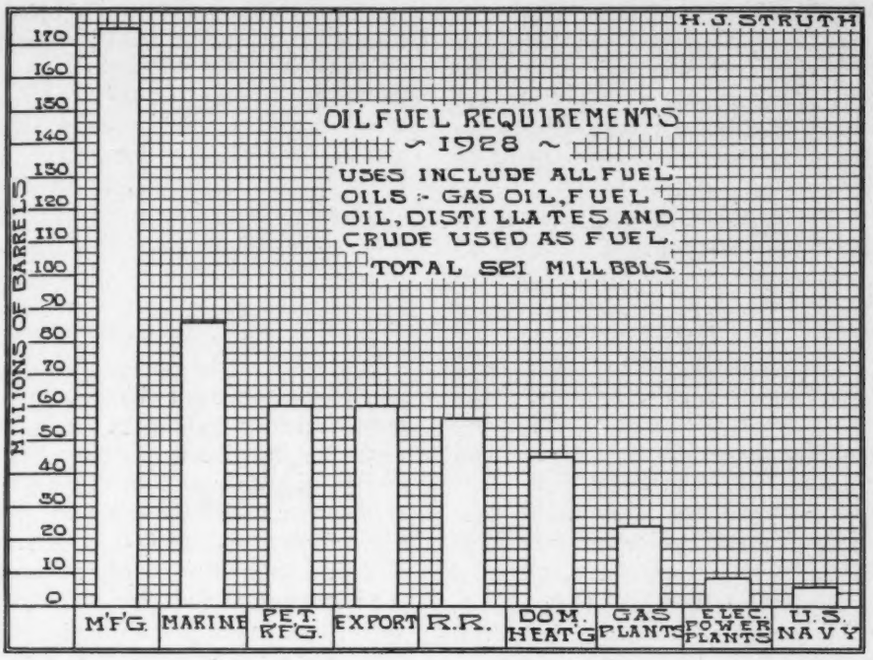


Home Heating Bright Spot in Refined Market Picture

Comparisons for 1928 show the domestic furnace demand now ahead of artificial gas manufacturing requirements

By H. J. STRUTH
Petroleum Economist

THE domestic oil burner can no longer be regarded a "mere drop in the bucket" as a consumer of petroleum products. The rapidity with which oil heating is being adopted by American home owners, apartment buildings, hotels and office buildings, reveals the domestic oil burner as an important refinery market factor. The significance of the oil burner as an important outlet in the refined oil market is exemplified by the consistent increase in demand for domestic burning oils during the past three years. In 1925 this demand aggregated about 18,000,000 barrels; 1926—25,000,000; 1927—34,000,000 barrels. This year, the writer estimates a demand of 45,000,000 barrels. Since our industry is confronted with the problem of finding new outlets for its surplus products, this new, rapidly growing, permanent source of demand furnishes a decidedly favorable development for the refining industry.

Some idea of the size of the 1928 fuel oil market can be gained from the fact that 16½ barrels of fuel oil are being consumed as fuel at every tick of the clock. Carefully prepared estimates reveal that the demand for oil fuels during the present year will aggregate approximately 521,000,000 barrels. This means that 55 per cent. of all the petroleum produced and imported by the United States is consumed as fuel, either in the form of gas and fuel oil, distillates, or in its raw state. This huge total will be divided somewhat as follows:

Estimated Fuel Oil Demand—1928
(Includes distillates and crude)

Manufacturing	175,000,000	barrels
Marine	87,000,000	"
Petroleum Refining	60,000,000	"
Exports	60,000,000	"
Railroads	57,000,000	"
Domestic Heating	45,000,000	"
Gas plants	23,000,000	"
Electric Power Plants	8,000,000	"
U. S. Navy	6,000,000	"
Total	521,000,000	"

The above facts are graphically portrayed in the accompanying bar chart. A similar chart prepared by the writer in 1925 placed domestic heating below gas plants, with a total of only 18,000,000 barrels. This year, do-

mestic heating occupies a far more important position, ranking considerably above gas plants as a consuming factor and within 12,000,000 barrels of the total fuel oil demand of our railroads. This places added emphasis upon the importance of oil heating to the refiner.

Industrial Use Up

While the use of fuel oil for manufacturing operations has for many years constituted a large proportion of the domestic demand, the influence of an unusually large supply, at low prices, has greatly accelerated the demand for industrial fuel oil this year. Many industrial plants have taken advantage of this situation by installing oil burning equipment, and a large number possessing such equipment have definitely converted their steam operations to the exclusive use of oil fuel. This has resulted in the placing of large contracts with refiners and marketers, thereby stemming to some extent the rising tide of surplus fuel oil stocks. The return of many former fuel oil consumers also constitutes a favorable factor in the fuel oil situation. Obviously, these consumers constitute a large market for fuel oil, but these consumers can only be retained on a low price basis.

On the basis of industrial horse power statistics, prepared by the United States Bureau of the Census, it is not difficult to determine some idea of how the industrial fuel oil demand is distributed. Chief among our industries using fuel oil, in the order of their importance. are iron and steel, car builders, foundries, smelting and refining, sugar refining, cement, ice manufacturers, paper and pulp mills, slaughtering and meat packing, shipbuilding, brick plants, automobile manufacturers, copper and brass works, chemical and dye works, flour mills, lumber mills and woolen mills. Since industry consumes a large part of the country's fuel oil requirements, we find that Pennsylvania, New York, California, Ohio, New Jersey and Illinois consume the bulk of our industrial fuel oil. In the above states there are many processing industries where fuel oil plays an important part. These states furnish a huge market for fuel oil—when the price is right—and should furnish an exceptionally good outlet at the present time.

Coal and natural gas are the chief competitors of fuel oil. Although coal offers none of the advantages obtained in the utilization of fuel oil, it is, nevertheless, a serious competitor of the latter. This is particularly true in the industrial field. When fuel oil prices begin to show definite signs of advancing, industry readily returns to coal, regardless of the fact that numerous other advantages must be relinquished. Since the fuel bill is one of the chief items in the manufacturer's profit and loss account, it is logical to expect him to favor the fuel having the lowest cost. This leads to the belief that some form of price stabilization will necessarily have to be worked out by the refining industry—if and when our present period of overproduction returns to normalcy.

In the domestic oil heating field, the situation is different. The average home owner is willing to pay more for the comfort, convenience and cleanliness that accompany the installation of automatically controlled oil heating equipment. An advance of a few cents per gallon for furnace oil would not influence this type of consumer to return to the use of coal.

A similar condition applies to the use of oil for heating large office buildings, apartment houses, hotels and other commercial buildings. Where natural gas is available, however, it is difficult to sell oil burners. As a matter of fact, it has been demonstrated, particularly in the Southwest, that natural gas is displacing other forms of fuel. This is due to the fact that natural gas offers all of the advantages claimed for oil fuel, eliminates the necessity of providing storage space for it, and usually sells at a lower price than other fuels. In the natural gas areas of the country there are considerably more than 1,000,000 homes heated exclusively with natural gas, and a great many large manufacturing organizations are able to use natural gas exclusively because of the attractive rates prevailing.

Relief to Refiners

The increased use of oil fuel during the present year will probably prove to be somewhat favorable to the refining industry. Although the market price of fuel and furnace oils will not advance above present levels, it is encouraging to note that this huge demand will have a tendency to arrest the growing visible supply to the extent of about 20,000,000 barrels. An analysis of the fuel oil situation shows that even though our stocks at the beginning of this year were considerably larger than at any time in the past, our surplus visible fuel oil supply will show some improvement. This is graphically shown in the accompanying chart which compares the visible supply of fuel oil with total demand over 12 years. This chart readily amplifies the unwieldy situation that has confronted the refining industry during the past few years. This year, however, it will be noted that the visible supply curve shows a slight tapering off, while demand turns sharply upward.

When we take into consideration all factors involved in the fuel oil situation we find that the immediate outlook is not conducive to an upward trend in the market price. It looks as though the refiner will continue for some time to experience a very good demand at present low prices. The following analysis, comparing the fuel oil situation for 1927 and 1928, will probably be of interest to the refiner:

Analysis of Fuel Oil Supply and Demand
(Millions of barrels)

	1927		1928
Refinable crude stocks Jan. 1st.....	309		372
Crude production	901		885
Crude imports	58		70
Total crude supply 1,268			1,327
Fuel oil proportion .....(47%)	596	(46%)	610
Fuel oil stock January 1*	49		62
Fuel oil imports	8		7
Total visible fuel oil supply.....	653		679
Domestic cons, and exports.....			435
Surplus	264		244

*Does not include jobbers' stocks.

While it is difficult to find any definite signs of immediate improvement in the fuel oil situation, it is at least encouraging to knew that the current demand outlook precludes the possibility of further sagging in the

price structure. No doubt the probable resumption of cracking operations, next year, combined with further increases in fuel oil demand, will bring about a more satisfactory situation. In the meantime, the refiner will necessarily be obliged to furnish the record-breaking fuel oil demand at present price levels.

Last year, there were more than 600,000 domestic oil burners in use in the United States. This year, according to a report made by the Oil Heating Institute, oil burner manufacturers anticipate an increase of 40 per cent, in the number of domestic burner installations. This means that there will be at least 800,000 domestic oil burners in use during the approaching heating season.

The small home equipped with an oil burner requires about 32 barrels of furnace oil during a full heating season. If we include all burners installed in homes, office buildings, and apartment houses, the average quantity of oil required per burner increases to approximately 56 barrels a year. At the rate domestic oil burners are being installed in the country, it is readily seen that next year's demand for fuel and furnace oils will probably very nearly equal our annual exports of fuel oils.

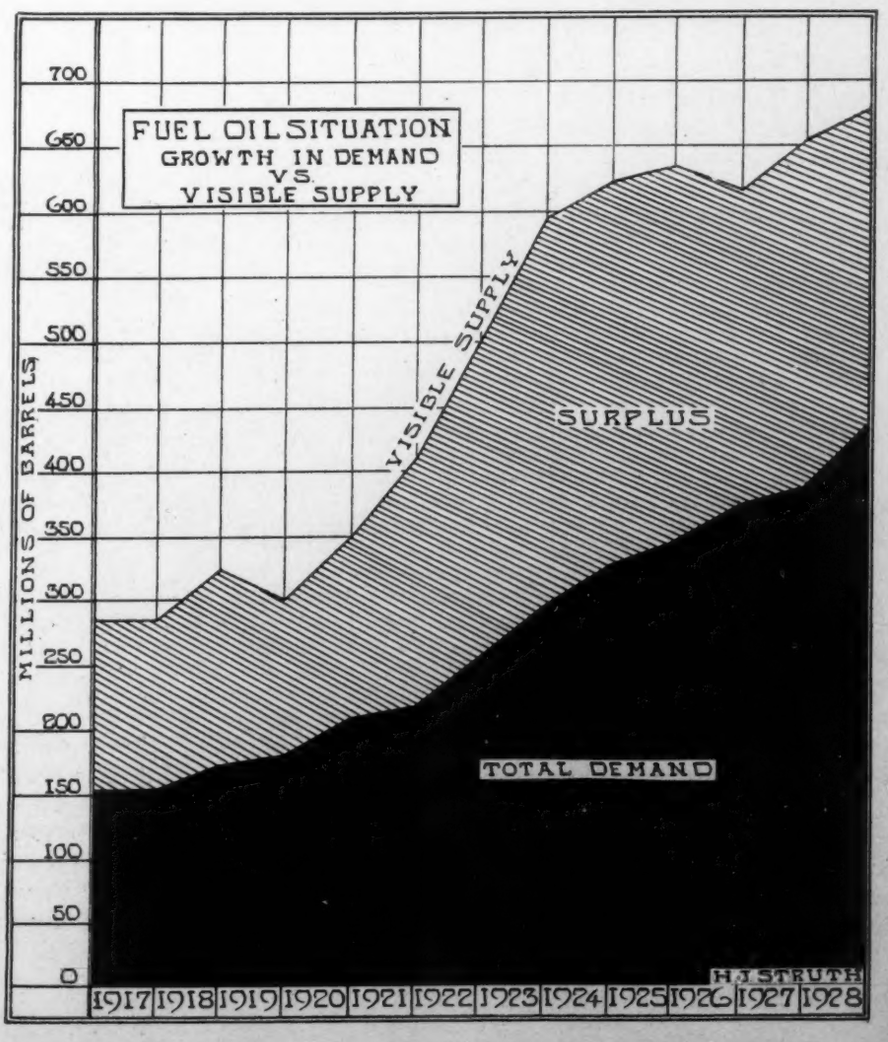
Some time ago, the writer made a study of the potential market for domestic oil burners. This resulted in the conclusion that there is a potential market, among home owners alone, for approximately 2,000,000 domestic oil burners. On this basis it is not at all difficult to foresee a demand for furnace oils alone that may aggregate 32,000,000 barrels. In addition, there will also be continued expansion in commercial oil burner installations, which will probably swell the total burning oil demand to about 125,000,000 to 130,000,000 barrels. This represents the future possibilities of oil heating in the United States. Thus, while future advances in the price of fuel oil may cause a decline in the demand for industrial fuel oil requirements, such declines will be offset by consistent increases in the demand for domestic fuel and furnace oils.

Plenty of Oil Now

Where it was formerly difficult to convince prospective oil burner buyers that there would continue to be an adequate supply of oil available, it is evident now that oil burner manufacturers are having no difficulty on this score. Rumors current to the effect that the oil industry was faced with an impending "shortage" have been substituted by the more modern ejaculation "flood." This turn in the tide of petroleum affairs has to a great extent been responsible for the increasing popularity of oil heating. With definite assurance of an adequate oil supply, at reasonable prices, all obstacles to the continued popularity and adoption of oil heating by the American public have been removed. This is bound to spell greater success and prosperity to oil burner manufacturers and, in turn, a consistent, healthy growth in the demand for fuel and furnace oils.

The economic limits of oil heating are really greater in scope than many would suppose. Its universal adoption is limited only by the scope of natural gas service. This means that practically 90 per cent. of all cities and towns in the United States may soon use oil heat, to the exclusion of other forms of providing this comfort. From a standpoint of cleanliness, ease of control, freedom from drudgery, and economy, fuel oil compares favorably with natural gas. The only appreciable difference is that natural gas, in addition to possessing these qualities, assures absolutely silent operation and requires no additional space for storage. The use of manufactured gas for home heating cannot be considered a serious competitor of oil heating, for the reason that present rates prohibit its universal adoption.

In summing up the fuel oil situation we find that there is nothing lacking from the standpoint of demand. That the industry is experiencing no difficulty to supply this demand is evidenced by the present huge visible supply of fuel oil. As long as the supply of crude and fuel oil continues to be maintained at present levels, there is little encouragement in sight for better fuel oil prices. The only real encouraging sign at this time is the present and prospective demand attributed to oil heating. This, coupled with the fact that next year's gasoline demand will probably bring about the full employment of cracking operations, offers the suggestion that the fuel oil situation may show a tendency toward equilibrium next year.



Making the Plant Physically Safe

By W. GRAHAM COLE
Lecturer on Accident Prevention, New York University.

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PROVISION for the physical safety of a plant should be the first item on the program for a safety campaign if it is to be successful. Mechanical guarding of dangerous machines and places is required by law in most states, as well as by causalty insurance companies. Since it is only a matter of time before all states will require thorough-going mechanical guarding, the installation of guards before such time should follow standards which will later meet state requirements.

The cost of making a plant physically safe is nearly always promptly repaid by increased efficiency of production, to say nothing of the savings in compensation or insurance costs. For example, the effort to make punch presses safe resulted in fundamental revision of the methods of feeding material to the press which permits one man to do the work formerly done by several. On other machines safeguarding requirements have necessitated changes which, instead of interfering with production, have speeded it up. If, in addition to guards, there are places on the walls for tools to be hung, and hall spaces where other equipment can be kept in orderly condition, workmen will be less likely to trip, and time will not be wasted in search for lost tools or equipment.

The best machine guard is the one built as part of a machine rather than as something to be attached to the machine or placed around it. Orders for new machines should, therefore, include specifications for guards, though many manufacturers are making guards a part of all machines even when this is not specified by the buyer.

Both state laws and good practice require the guarding of all moving parts with which anyone can come in contact. The necessary guards can be made in the plant by any able mechanic, using materials usually available in most plants or which can be purchased from any of the several companies which make such materials. In a large plant, it is advisable to set up a separate department which will be responsible for the construction, installation and repair of all guards. In a small plant the construction of guards should be delegated to a good mechanic who should be permitted to spend as much time as is necessary at this work.

A Specialist More Efficient

It has been found better to assign the guard making work of the entire plant to one man rather than to a different man in each department. A man will take greater interest in guarding and become more expert in the work when it is his most important job, than several men to whom constructing guards is of secondary importance. The one guard maker can also develop a standard type of guard for the whole plant, saving money and bringing about a desirable uniformity of appearance. State labor and insurance company codes should be consulted, to be sure that the construction of guards conforms with state and insurance standards. Codes for guarding can also be obtained from the Bureau of Labor Statistics of the United States government and from various safety organizations.

A good guard must meet several requirements. It should be neat in appearance, since neatness is one indication of safe conditions. It should be durable, able to withstand any impacts to which it may be subjected. It should be practical, not interfering in any way with the operation of the machine. It should be easy to remove and replace, and not attached to the machine in such a way that it cannot be removed quickly when repairs are necessary. Unless its construction is such that is can be put together again quickly, it is likely to be left off for days or weeks after the machine has been moved or repaired. A guard which is removed and not replaced constitutes a greater hazard than no guard at all, since the workman has become used to it and will be more susceptible to accident without it. Ordinarily it is best to construct the guard on hinges so that it can be opened easily for oiling and inspection.

Co-operation Necessary

Since the cooperation of workmen is necessary in their use, the men should be convinced that guards help rather than hinder them. Often a workman can be led to make a good suggestion about a guard, which assures his cooperation when the guard is adopted.

For ultimate economy, guards should not, in most cases, be made of wood which is weak and expensive to replace. Wood also constitutes a fire hazard, especially when oil-soaked. It is, however, necessary in plants where acids are used, and it may be desirable in woodworking plants or in temporary plants. Good guards can be made of wire mesh or of one of the several perforated or expanded metals manufactured for this purpose.

Real as well as apparent hazards should be sought out and guarded. The oiler goes to the most hazardous places in a plant, and is often injured. Such places should, therefore, be guarded, even if no one goes there but the oiler, and he infrequently.

Belts or gears are found in practically every plant, and their guarding, which is typical of all guarding, may be mentioned briefly. Most state laws require the guarding of belts to a height of at least six feet above the floor. Safe practice requires that belts should always be guarded to above the point where belt meets pulley, and where clothing or other things might be caught. Cast

iron foot rests or sockets screwed to the floor, with angle irons placed in these and held by set screws provide a good basis for the construction of substantial belt guards which are easily removed. The material of which the guard is to be made is attached to the angle irons. Through the use of hinges or latches to hold the material, any portion of the guard can be opened or removed easily to permit repair.

Gears should be guarded carefully, at the sides and back as well as in front. A gear guard may be made of heavy perforated metal or of other material able to withstand any pressure placed upon it. Gear guards of wood or other comparatively weak material constitute a more serious hazard than no guards. When there are many gears exactly alike in a plant, castings may be made for their guards; these should always be attached firmly and rigidly.

In addition to machine guarding, there are other requirements for physical safety. Most state codes require the guarding of stairways with handrails three and one-half feet high. The handrails should also have a bar half way up and floor boards at least six inches high to keep materials or tools from falling and striking someone below. Stairways should be kept in constant repair and well lighted.

It is safer to have individual motor drive for each machine than to have all machines operated from a line shaft. If there is a line shaft, each machine should have separate control so that it can be stopped and started independently of the others. This is important for the prevention of serious accidents when someone becomes caught by a machine in any way.

Many accidents occur through the use of hand tools which are not in good condition. All tools should, therefore, be inspected regularly. Proper clothing, also, should be worn by the workmen. For example, it is necessary for a workman in a foundry to wear gloves, where is would be foolhardy for a man working on a machine to wear gloves. Nor should clothing have loose ends which could be caught in machines.

Can the Credit Man Remake Policies Of the Petroleum Industry?

By W. A. RYAN
Credit Manager, Mid-Continent Petroleum Corporation.

Paper read before Refinery Credit Managers Association, Chicago, September 4, 5 and 6, 1928.

IN these days of militant activity in business, professions, politics and what not, there is manifest a crusading spirit that may require some comment. The credit organization in the petroleum industry has not been immune and it is to this that our thoughts are directed. Your true crusader is usually much in earnest and it is difficult at times to dissuade him from his purpose. Likewise, the same zeal that fired his spirit to wage war on many things, has convinced him that he is a progressive. Commendable as is the progressive spirit, there may well arise the question—who is the progressive; and if you have heretofore solved that puzzle of our youth, "how old is Ann," you will have determined for yourself your own answer.

In this spirit, we have encountered some of our associates so earnest in their purpose that they have applied the term, "yes men," no doubt in a spirit of derision, to those who are not ready to follow them in their campaign for betterment. They have advocated changes for good no doubt, but have also demanded other changes that were not and are not practical. It is not fair, therefore, that they assume, without opposition on the part of the conservative, that they alone are for progress and uplift; and that any opposition to their plans comes and can only come from the reactionary element. It is with the hope of suggesting clear thinking on both sides of mooted questions that there is hope of progress. Not every conservative is an obstructionist.

In the past, issues have been clouded by the vehemence of the crusader; he takes the stand that the conservative has neither a leg to stand on nor a defense worthy of the name. May we not, both sides, submerge all personal vanity; and the ambition to leave our imprints, not alone on this gathering but, in a more permanent sense, on the industry; and resolve to carry on our work earnestly and without ballyhoo.

I hope that those who a few years ago advocated certain changes in the terms on refined products will not take offense at criticism that is wholly impersonal. The changes advocated were a departure from accepted precedent and in theory were very fine. As a matter of fact, our efforts should be and usually are directed towards narrowing the accommodations sought for by the customer and usually advocated by the individual salesmen as a means to increase his gallonage. When, however, the changes are of such a revolutionary nature as to strike at customer relationship, they encounter opposition that may not be easily overcome. In this sense, the movement may be considered impractical and no amount of fine theorizing can alter either its nature of the effect produced upon those whom it vitally affects. It is an accepted fact that all progress has been achieved only by reconciling many conflicting viewpoints and is, therefore, the result of concessions on both sides. An honorable compromise that results in actual good is not to be despised and seems to me preferable to a determined opposition that leaves the question unsolved and neither side satisfied.

The Value of Exceptions

On the floor of this convention two years ago, there was presented a code of terms by Mr. Hallman, who

was the Credit Manager of Sun Oil Company, Philadelphia, which won the unqualified commendation of all the delegates. His address is in the minutes of the meeting and as a matter of record need not be restated here in detail. You will recall, however, that while these terms did not depart noticeably from those which any board of directors and any sales executives have already sanctioned, they simply restated the compact between company and customer that the most militant credit manager would demand. In other words, it served the useful purpose of an inventory and brought us face to face with conditions usually confronting us and set up a standard of measurement by which we might be governed. If, on the other hand, we had been less strict than perhaps we should have been, here was a standard for our guidance. If, however, our training had been more rigid and we were inclined to assume that no one was entitled to other than sight draft terms, we were shown admirably that customers were receiving accommodation, and the degree of accommodation was fully set out.

It may be well, therefore, at this time to refer to that code and to determine by discussion whether conditions in the industry have altered to such an extent that any or all of its purposes have become obsolete. Personally, I do not think so and the isolated exceptions that arise ever and anon demonstrate this more fully. It is in fact the exceptions in any line of endeavor that keep us alert and prove our fitness or unfitness for the daily tasks of our business day. Those of you who have enjoyed the benefits, and are now reaping the fruits of a higher education, will recall that for every rule in your text books or expounded in lectures there were usually many exceptions; and mathematics was not immune.

In point of fact, the code presented by Mr. Hallman was designed to regulate our normal contact with the trade; but there are so many abnormal and subnormal instances which no rule of thumb can cover, that the credit man has the daily experience of traversing uncharted seas. By this time, perhaps, my own words have convicted me; and to the ultra progressive I am a hopeless reactionary. But let us repeat that phrase "uncharted seas" and apply it to our own case. Is there any avocation that offers the limitless variety of human contacts and ever new experiences that confront the credit man daily? Things begin to hum with the opening of one's dask and when the first orders pour in, anything can happen, I find. There are the night telegrams from division officers to commence on; and when the mail is brought around, there is plenty of material for thought. There are the first orders that demand instant attention—and how! And those from the occasional customer whose methods you can never quite gauge; and those whose payments must be in hand before you will ship another car; and—but the variety is infinite. And you bombard your bookkeeper with a list of accounts, for you must know now how each one stands; and he wonders why you don't either take them or leave them, and not bother him. And the handling of that class of business that you have decreed must be cash, requires a wide variety of treatment. Of course a draft is a draft, and that's that! But if you have a big local business then your terms are as numerous as your several customers, as each is a separate case and must be handled individually. In some cases it is cash in advance; in others cash with the papers; in others we get so big-hearted we call up on the telephone and give the details, anticipating a call later in the day with a check. And we may even mail the papers out in town and not bother about it further for fully 48 hours. I recall an instance of an occasional shipment on draft to a prepay station, necessitating an open bill of lading. Here we wire the man's banker the estimated amount and await his reply guaranteeing payment before shipment is made. So if anyone can sit back and formulate a rule, or a book of them, that will fit all these cases, he is, as Kipling says of Gungha Din—"a better man than I."

Watching Conditions

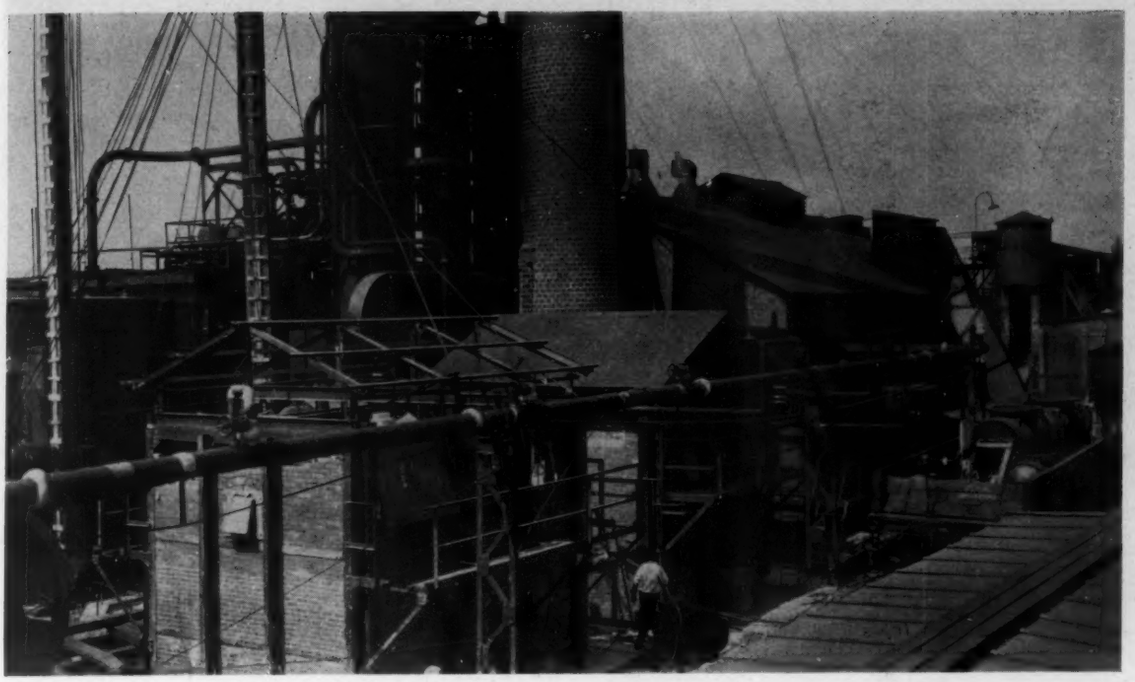
Do you find it interesting and profitable to keep up with the reports of crop yields, progress of the harvest, movement of live stock and the approximate prices of the grains in your marketing territories? Where so much depends on agricultural conditions, these data are a necessary adjunct to your other reports and are of material assistance in determining your general policy. If used as a forecast, and they are always available as such, you can plot your cause to a certain extent for some months in advance, and be of assistance to your salesmen in so doing. Besides, a knowledge of the preponderant product in various sections of your territory, enables you to meet the customer on a more intelligent footing; and to discuss his problems on a basis of personal interest and sympathetic understanding. And believe me, big business more and more emphasizes the necessity for the human and personal element that creates and holds good will. It is idle and empty to talk of service, unless we apply it personally; in the abstract, it means nothing but a phrase.

Nor can we hope to serve our companies as fully as we should, if we fail to inform ourselves from day to day of conditions in our own industry. It is a fact that our trade papers are very well written, illustrated and edited; and are literally packed with news of every phase of activity in our many sided industry. There is, if anything, too much of it to read it all and keep our work going. Yet we can manage to select those items relating to the production of crude; inform ourselves on stocks; keep abreast of the refined market from day to day—and all of you can testify to this year as one of frequent price changes. And if we can digest this maze of figures and not get dizzy; if we can avoid confusing barrels with gallons, or vice versa; and still keep up with our collection files, that is an achievement not to be dispised. Along these lines too, it may be pertinent to state that time flits by very swiftly and files must be kept up to date. The system one may pursue forms a subject in itself, and I hope some day you experts will take me aside and point out time and labor saving methods. We have a large number of accounts and the revision of these is really stupendous, when done in conjunction with the other demands upon our time and energy.

Where is the Limit?

If we could draw a line at some definite point and say: "that's where the credit department begins to function" and over there another, and say, "that is the final boundary of my domain"; if we could do that as easily as we

(Continued on page 66)



General view of Freedom Oil Works Company's new tube still distillation equipment at Freedom, Pennsylvania. The first small still to the right is the reducing unit for pressed distillate. The center still is used in skimming, and the heater under construction is part of the new vacuum distillation unit.

Tube Still Yields Pressable Wax Distillate

By GEORGE REID
Associate Editor

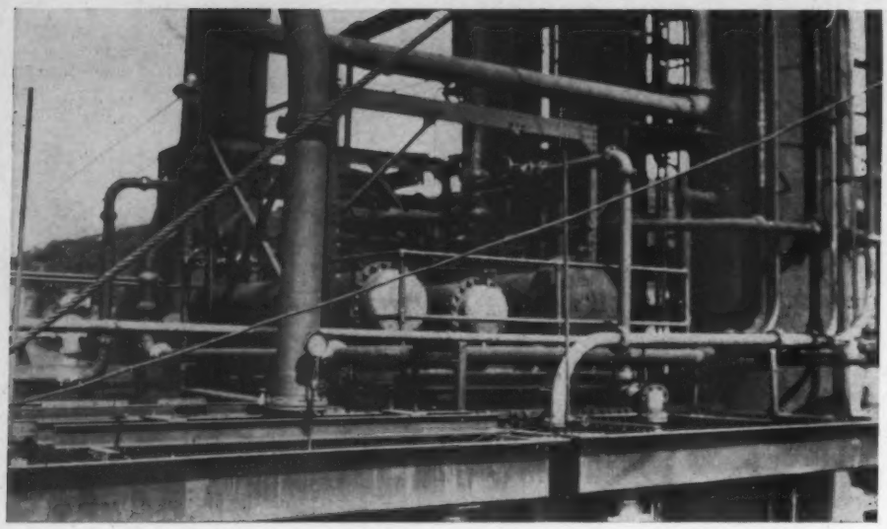
AS the pipe still and bubble type fractionating column have developed to their present efficiency, their application has been more and more widespread among eastern refineries, where it has been utilized for a number of steps in the processing of crude. Now comes the complete refinery with all its distillation work performed in tube stills. Crude is skimmed and fractionated in very flexible units which produce not only the usual products of gasoline, kerosene, and gas oil, but a pressable wax distillate and long residuums. The pipe still is still further employed toward elimination of the shell retort in its utilization as a reducing unit; operating continuously in this work instead of batch. It appears again in the modern installations of vacuum distillation equipment, and in re-distillation work where pressure distillate must be processed.

One of the early installations, involving rebuilding of distillation equipment and discarding of the old shell still equipment, is at the refinery of the Freedom Oil Works Company, Freedom, Pennsylvania. At this plant the entire battery of shell stills was dismantled to make room for three small pipe stills and their conjunctive equipment. The first tube still installed replaced the crude skimming battery; the second performs the work of the old reducing, or rerunning, shell stills; the third pipe still, not yet completed, is the heater coil for the vacuum distillation equipment.

The first tube still unit installed for skimming plant practice is very flexible. It operates under the flash system, which involves the use of one large bubble type fractionating column and a number of smaller stripper or flashing sections, fabricated in such a manner that it appears as a second tower. The design lends itself particularly well to accurate control and flexibility and ease of operation.

The tube still consists of a bank of three-inch O. D. tubes in which the oil is heated to about 700 degrees at the rate of 2200 barrels per day. The still was designed for 2000 barrels. It is very compact, and although it is equipped with air preheater equipment, and adequate control devices, it has the appearance of being a still of much smaller daily capacity than 2000 barrels.

The tubes are short, and the oil passes through the unit at a very high velocity. The Worthington charging pump handles the ingoing cool crude through the exchangers and to the still at pump pressure of about 250 pounds. The still is not fired hard, and furnace temperature is usually around 1400 degrees. The freezing temperature of oil going into the still is 360 degrees. The equipment used, such as tube still and fractionating equipment, is Badger type and was constructed under



Heat exchangers mounted on top of condenser box close to the source of hot oils which pass through them, preheating the crude.

the design of Dr. E. H. Leslie and H. J. Smith, prior to the formation of the new Smith & Leslie, Inc., Engineering firm at Oil City. Units similar to the one under discussion are being erected at the time of this writing, at Emlenton and Oil City, Pennsylvania. The design of this equipment provides for high velocity of oil through the tubes and this turbulance prevents any damage to the oil as it is heated. In fact, a temperature of 700 degrees and above with the flash system produces an excellent colored cylinder stock, due, principally to the very short length of time the oil is held at the high temperature.

The pipe still unit, since it lends itself to continuous operation, makes possible the recovery of heat by conducting the incoming oil to be heated into thermal contact with oil or vapors which must be cooled. Crude charged to the Freedom distilling unit passes from the tank to a series of Ross heat exchangers. The first exchanger is mounted at the top of the bubble tower, where gasoline vapor to oil exchange partially preheats the crude. Passing from this exchanger the oil is conducted to the second where exchange is with hot wax distillate, and the crude temperature is increased to 275 degrees. The third exchange is with the bottoms in the same type of equipment, and results in a preheat of 360 degrees. In the tube still this temperature is increased to 700 degrees and it flashed into the lower compartment of the large bubble tower at this temperature.

Fractionating System

The combined separator and bubble tower is of the multiple stream type, which means that in addition to bottom and top streams, a number of side streams are taken at intervals from a certain number of bubble trays. These side streams are finished to almost any desired specification in stripping sections of the second column. The primary tower is six feet by 76 feet in dimensions.

As the heated oil and vapors are flashed into the bubble tower, the vaporized portion rises through the bubble trays. The unvaporized residuum is either removed from the bottom of the first tower or flows through a control line into a stripper section in the second column where it may be flashed to specification with steam.

The stripper sections are actually small bubble towers, mounted on top of each other, but acting as individual towers. Each is independent of the other, but the design wherein they are mounted vertically one upon the other secures simplicity of construction and less costly insulation of the single column.

As the vapors rise in the primary fractionating column they are condensed and scrubbed as they pass through the bubble caps or trays. The side streams are taken from the individual trays through small outlet lines. These lines are manifolded and arranged in such a manner that the desired number of side streams may be secured to produce any single desired fraction, such as naphtha or kerosene.

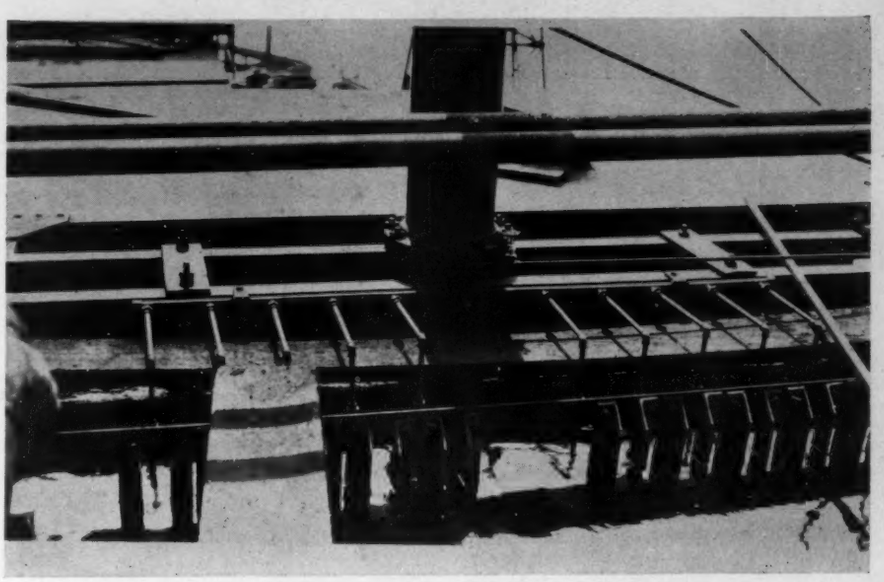
The long residuum or bottoms are first removed, and they may be taken either direct from the first tower or conducted to a stripper section and then removed to storage, according to the manner in which the plant is operating.

The next cut removed from the side of the tower may be a slop cut, or a wax distillate cut, either of which does not require further treatment in a flashing

Interior of receiving house at Freedom Oil Works Company's Refinery. Direct Reading Weir look boxes.

section, but is removed through the heat exchanger and cooling coils to storage.

Further up the tower gas oil or kerosene is taken from the side of the bubble tower to a stripping section, flashed to specification with steam, passed through a heat exchanger, and cooled for storage. A side stream of varnish makers and painters naphtha is taken from the next higher series of bubble plates, passed into a stripper section and flashed to specification. From the top of the tower the overhead vapors are conducted through the vapor heat exchanger, and to cooling coils.



Details of method of injecting small quantities of caustic solution into the condenser coils to combat corrosion.

Flexibility

The specifications of the top or overhead stream and all side streams may be changed at will and the fractions varied to meet market demands. A very light gasoline may be taken overhead and a naphtha from the first or topmost stripper section in the second tower, for example. In each of the stripper or flashing section, the vapors removed by the use of steam for flashing are conducted through small vapor lines back into the first fractionating column. When U. S. Motor gasoline is desired from the overhead stream of the first tower, then a kerosene, which can be produced with a number of gravity and boiling point ranges, is taken from the first stripper section. Gas oil would be produced from the second flash section, and it too is variable as to specifications. The over-all dimensions of the second column of stripper sections is 4 by 56 feet.

The fractionating equipment is lacking in operating rigidity. Its flexibility is of importance in that any grade of motor fuel, naphtha, kerosene, or gas oil may be fractionated and condensed. Still further evidence of flexibility is found in the fact that negative gaps are produced at will, where and whenever necessary, between any two fractions removed, and the control is simple and positive.

The wax distillate produced in this pipe still operation, is pressable. It is taken to the wax plant and handled in the usual manner. When the construction work now in progress on the Badger vacuum distillation unit is complete, it is planned to dewax the oil by means of centrifuges. At present the oil is dewaxed in the conventional wax press and the pressed oil taken to the small pipe still and reduced continuously. The tubes in this unit are very small, and the velocity is high. The still is equipped with a separate bubble tower which fractionates the vapors and oil, yielding gas oil over head, non-viscous neutrals from the side, and viscous neutral from the bottom.

Tube Still Advantages

The new vacuum unit under construction is designed to operate at 700 barrels per day capacity. The tube still is similar in design to the skimming plant retort. This latter still, without the air pre-heater equipment, secures a thermal efficiency of 75 per cent. With the air preheating equipment in service it is stated that the pipe still rates as high as 82 to 83 per cent. thermal efficiency.

The tube still operation in refining Pennsylvania crudes has a number of features in its favor as compared to shell still operation, which advantages are too well known to enumerate here. The cost of the small auxiliary units required to bring the shell still up to a comparable basis of operating cost with the pipe still is much greater per barrel throughput than that of the tube still unit.

In operation with Pennsylvania crudes running down to long residuum the wax remains in the long residuum and it is removed in the conventional manner by centrifuging. Running to cylinder stock base for bright stock, the wax is taken overhead in two cuts, usually, one of which is pressable—and the other must be cracked to render it pressable through filter pressing equipment. The tube still with its several advantages and in its modern development, is becoming extensively employed among eastern refiners, where once, not so long ago, it was thought impossible to make lubricating oils in this manner.

The vacuum unit, such as the Freedom unit, and others perfected by other engineering companies in the last two years, are also becoming popular. They have the important advantage of producing oils which do not require filtration, and possess certain advantageous specifications.

Corrosion

At the Freedom plant corrosion of the condenser coils is combatted by the injection of small quantities of caustic solution into the head of the coils. Some refiners inject caustic into the stills with the crude, but at this plant the caustic is taken from a small storage tank mounted on top of the condenser box, and passes through a single small line to a header where it is distributed through a number of small lines to the top pipe of the condenser coil. The quantity of chemical required is very small, and its use has retarded the action or destruction to such an extent that it is considered almost negligible.

Can the Credit Man Remake Policies of the Petroleum Industry?

(*Continued from page 62*)

used to bound, for instance, the state of Missouri, in the old geography classes, wouldn't it be simple? We could then determine just where reform was necessary; set about correcting the condition and presently it is all accomplished—just like that. Recently Abe Martin got off this one: "Why don't women reformers begin on their sisters?" and of course many a man will echo, "yes, why 'n 'ell don't they?" The point I want to make is, however, this: Our efforts infringe upon those of so many other departments of our organizations, it is extremely difficult, if not impossible, to determine where one begins and another tears off.

Take, for instance, our contact with the sales department and with individual salesmen. It would be indeed reactionary to ignore their point of view and assume the attitude of aloofness or superiority, thus losing a valuable source of information. Who has not found himself warming at time to their enthusiastic recommendations for big business in prospect and the many influential features of such a connection? It fires the latent spirit of salesmanship that lies within all of us, together with a natural desire for expansion of our company's influence. To be carried away by such influences, however, to a point of granting credits, based on emotion and impluse is of course, considered unthinkable and not to be intruded upon the deliberation of serious men. Yet, who can deny the necessity for knowledge of merchandising methods in the wholesale and retail fields as of assistance in our activities? Likewise, who can deny the advantages to be gained from these contacts in impressing upon our salesmen the necessity of their being supplemental credit men and viewing their prospects in accordance. To impress upon them the futility of expending effort indiscriminately in their territory instead of centering upon those of high character and good business methods is a constructive step. To impress them likewise with the understanding of our desire to assist them in increasing their sales by sincere co-operation, removes that nameless barrier that sometimes arises between these essential branchs of the personnel; and would demonstrate to them our preference to pass orders rather than reject them.

Reverting also to our previous statement covering customer conference, this knowledge of their merchandising problems and the information that may be gathered from them by direct contact, inspires them with a greater confidence in our ability to deal with them and can be made a distinct factor for the promotion of good will. In other words, without sacrificing the prerogative accorded us of the selection or rejection of any or all business offered, this process may be simplified by eliminating all barriers of mistrust and ill will.

Credit Man Must Lead

To sum up in a few words the ideals of our activity, there are many influences working for progressive and constructive effort; and none apparent to inspire us with an ambition to do radical things. We touched frequently upon but did not condemn that movement that sought to impose upon a number of the refiners in our Interchange Bureau a code of terms affecting primarily gasoline and kerosene, that were revolutionary. I believe that the plan received attention at the hands of the higher executives of all companies and was given a sympathetic hearing. That it has not been put into practice seems proof that it was considered unworkable. It has been our endeavor to summarize the multiplicity of influences against which the plan necessarily contended and its difficulty of being steered through the breakers to a safe harbor. May one be reactionary to oppose that on which he himself is not sold; and at least to recognize the difficulty of selling it to those intrusted with the exercise of final authority?

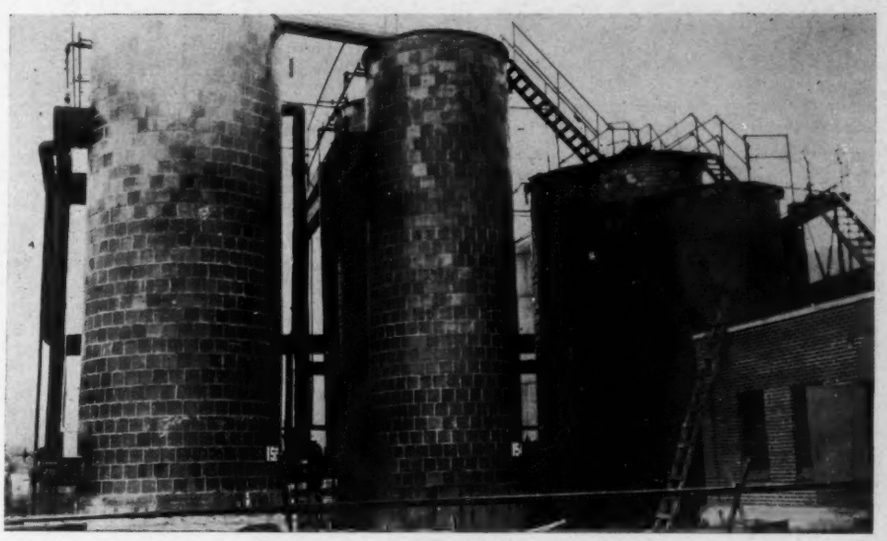
All of which brings us face to face with the question —"can the credit man remake policies of the petroleum industry?" He can if he first puts his own house in order and makes his own department an institution of foresight, personality, accuracy and dependability. Further, if his relationships based upon the numerous contacts herein enumerated, demonstrate his ability for calm judgment and sympathy. With an understanding of the viewpoint of the other fellow, his capacity will be utilized to expand constantly the number of his customer accounts and the corresponding volume of merchandise, thereby doing his bit towards controlling overhead and keeping down the ratio of bad debts. If he recognizes the necessity for courage in taking on new commitments and has the backbone to accept his responsibility in such cases where disaster follows; if he faces squarely the necessity for progressive increase in sales without overlooking the hazards attendant upon all forward movements; if he is capable of being conservatively enthusiastic and enthusiastically conservative and can steer that happy course between the two extremes of unbridled optimism and morbid pessimism; or as it has sometimes been put, "be neither a big hearted Benny nor a cautious Clarence," he can and will fulfill his destiny.

Let him by this means prove beyond cavil, to all his associates, his integrity and reliability and he will have done his bit towards remaking the policies of the petroleum industry. Let him conduct himself and his department organization earnestly but let him not take himself too seriously. Like a well tempered spring there must be elasticity as well as tension. Let him finally consider himself one of the component parts of a great organization embarking on an adventure promising glory and reward for successful achievement but one which demands the exercise of every good quality possible to man and he will have contributed his part to remake of our industry a profitable, likeable and successful giant among the industries.

Continuous Chilling System Perfected at Pennzoil Plant

By GEORGE REID
Associate Editor

THE program of improvement and enlargement of capacity in all departments at the Oil City refineries of the Pennzoil Company has continued through the past year, until the combined daily crude capacity of the two plants is now about 10,000 barrels. Last year a modern skimming plant was added at plant No. 1 and two Dubbs cracking units installed at plant No. 2. These features were discussed in a previous article appearing in THE REFINER AND NATURAL GASOLINE MANUFACTURER of October, 1927.



Chilling is done continuously in these batteries of chilling tanks, at Pennzoil Company's No. 1 refinery, Oil City, Pennsylvania.

During the past 12 months Pennzoil Company has added several enlargements and improvements in operation. Included in this program are the new additions to the lubricating oil manufacturing department and consists of such items as additional wax pressing equipment, enlargement of the refrigerating plant, a new wax sweating plant, and a new centrifugal dewaxing plant. A third Nichols-Herreschoff fullers earth roasting furnace is under construction. Additional chilling tankage and systems have been added to handle present production.

At the No. 2 plant, a modern rerunning system has been installed which consists of pipe still equipment for redistillation of Dubbs pressure distillate. An efficient gasoline recovery plant of latest design has been added, and two continuous treating plants have been installed for treating both cracked and straight run gasoline.

During the coming year several further additions will be made at the Pennzoil plants.

Continuous Chilling

In the recently completed additions to the company's lubricating oil department there are several interesting features of design and construction, as well as features having to do with utilization of waste heat and cold.

At the department given over to chilling of the lubricating oil stocks prior to dewaxing by the centrifuges, the chilling is done continuously, and involving the use of the continuous chilling process invented and patented by L. D. Fulton, superintendent of the Pennzoil Company refinery. In this system there are three batteries of chilling tanks. Two of the batteries consist of two large chilling tanks, and the third battery has three chilling tanks connected in series.

Following the oil through the chillers in the manner in which it is processed, the stock to be chilled is received by the first tank in the series at the top. This flow is regulated and controlled by a liquid level controlling device placed at the small tank where finished oil leaves the centrifuges. In other words, the same quantity of warm oil is received at the inlet to the chilling system, as the volume leaving the other end of the process after dewaxing. The liquid level controller governs the pump charging fresh oil to the system.

Entering the first of the chilling tanks the oil is chilled slowly. The first or upper coil in the top of No. 1 chiller has finished, cool, dewaxed oil flowing through it, which is the outgoing oil from the centrifuges. Below this coil the partly cooled oil passes downward and over other coils in the bottom of the tank through which cold brine is circulated. Leaving the bottom of the first tank the partly chilled oil passes into the top of the second chilling tank of the series, where it is chilled to the desired low temperature in passing downward around coils nested in that tank through which cold brine is also circulated. From the bottom of this tank the oil flows directly to the centrifugal dewaxing plants which are located in two small buildings adjacent to the chilling system.

The size of the tanks are so calculated that the rate of flow of oil through them and into the centrifuges is very slow, and the same time element, which is essential in proper chilling for crystallization of the wax particles, is secured, as is obtained by the batch chilling method. The chilling of oil from around 90 F. to below zero temperature in this system is as slow as good practice dictates. Further, there is no "shock" chilling, for the first drop in temperature is secured as the warm oil passes the first or upper coil in tank No. 1, through

Brine cooling equipment, as shown, is installed outside, well insulated, and as near to the department where needed, as possible. Small buildings house the transfer and circulating pumps.

which cool dewaxed oil from the centrifuges is passing. The temperature gradually drops as the oil flows through the two tanks in series, to emerge from the bottom of the final tank, at the proper low temparture. The system is as elastic, in the matter of securing various low temperatures, as is the batch tank system.

Control System

The controller, which governs the operation of the charging pump, effects the injection of the oil charged to chillers, providing a like volume to that leaving the centrifugal machines. A gauge glass is provided at the top of the first tank in the series which indicates to the operator the liquid level in the tank, and acts as a check against the control devices. The brine cooling equipment is located at the side of the centrifugal dewaxing plant, instead of at the centralized refrigeration plant proper. This is also true of the brine coolers required at the wax pressing houses. The refrigerant is compressed at a centralized refrigeration plant. The compressed ammonia is distributed through insulated lines to the various chillers, or brine coolers, at the points where it is needed. After expansion in the brine coolers, it is returned through uninsulated lines to the central compressor station or refrigeration plant.

The practice is unusual. It permits of greater flexibility of cooling the brine, however, in that each department can look after its own refrigeration and secures those results peculiar to their needs. Also, all compression and other equipment necessary to the refrigeration plant is centralized in one building and the equipment gets better attention.

The refrigeration equipment consists of one 100-ton Carbondale plant, one 75-ton, one 65-ton Carbondale plants, and two 100-ton York plants. Steam for the refrigeration equipment is derived from the electricity generating plant in an adjacent building, where steam at 150-pound pressure, superheated, is utilized to drive steam turbines driving electric generators, and the exhaust steam at 25-pound pressure from the turbines is used by the refrigeration plant, and in certain other departments.

At the brine coolers centrifugal pumps are employed in the circulation of the brine. A 30-horsepower Crocker-Wheeler motor drives a Worthington centrifugal pump, which circulates brine through the coolers at the rate of 600 gallons per minute. Stand-by pumps of the same type, and Goulds centrifugals for circulation of brine through the coils are employed.

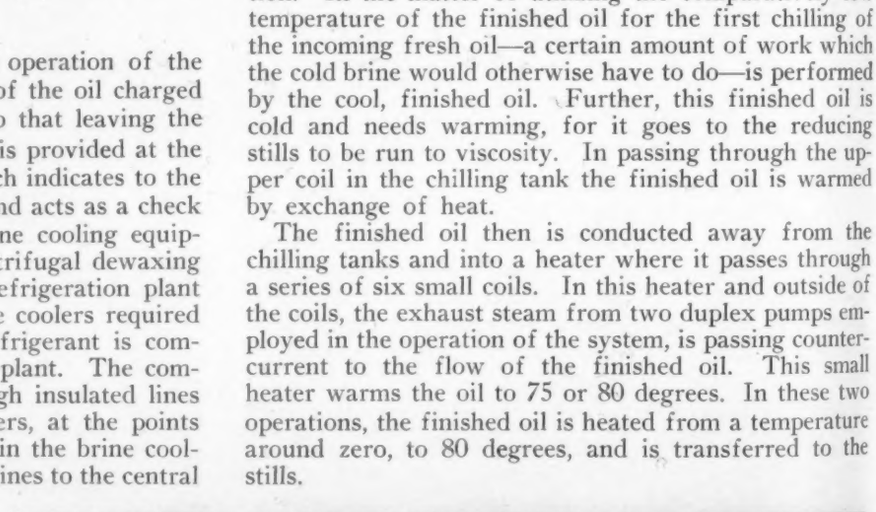
Dewaxing Plants Separate

Usually, two of the batteries of chilling tanks are in operation simultaneously and the third battery is held as auxiliary. This makes for continuous operation, since all oil chilling equipment must occasionally be cleaned.

Two Sharples centrifugal dewaxing plants are provided, each operating in its individual small building as a safety measure. The buildings are fire proof and provided with double steel frame windows. The older plant consists of four Sharples super-centrifuges and two De Laval centrifuges. The new plant is equipped with five of the latest type, vapor tight, Sharples machines. They are installed in separate buildings of brick and concrete, for the reason that such practice reduces the hazard in the event of fire in either plant.

The design and operation of this chilling and dewaxing plant as described, lends itself to economical operation. In the matter of utilizing the comparatively low temperature of the finished oil for the first chilling of the incoming fresh oil—a certain amount of work which the cold brine would otherwise have to do—is performed by the cool, finished oil. Further, this finished oil is cold and needs warming, for it goes to the reducing stills to be run to viscosity. In passing through the upper coil in the chilling tank the finished oil is warmed by exchange of heat.

The finished oil then is conducted away from the chilling tanks and into a heater where it passes through a series of six small coils. In this heater and outside of the coils, the exhaust steam from two duplex pumps employed in the operation of the system, is passing countercurrent to the flow of the finished oil. This small heater warms the oil to 75 or 80 degrees. In these two operations, the finished oil is heated from a temperature around zero, to 80 degrees, and is transferred to the stills.



Heater in which exhaust steam is used to preheat cold lube oil leaving coils in top of chiller tanks, and en route to reducing stills.

PROCEEDINGS OF THE NATIONAL PETROLEUM ASSOCIATION

Wide Range of Subjects Covered in N. P. A. Sessions

Twenty-sixth annual gathering of oldest oil men's association is held at Atlantic City

By GEORGE REID
Associate Editor

ATLANTIC CITY, N. J.—In his opening address before the first session of the twenty-sixth annual meeting of the National Petroleum Association, which convened here September 19, E. M. Lyons, president of the association, complimented the past success of "the pioneer among petroleum associations" and expressed his appreciation of the privilege of being permitted to enjoy the fruits of the association's untiring and ever progressive co-operative efforts. The "N. P. A." has been termed, and truthfully so, "the pioneers in the adventure of co-operation in the oil industry." Mr. Lyons said in part, "It has been and is an adventure."

He recalled the existance of a common enemy which was conducive to the organization of the co-operative adventure 26 years ago—an enemy outside their gates. "In these later days our members are experiencing a different adventure in co-operation. The newer enemies are within. We are seeking to replace ignorance with knowledge, to operate our plants more efficiently, to market our products with less expense, to cultivate more cordial relations with the public we serve. In this adventure the problems are more subtle and their solution requires greater candor about ourselves. As the pioneer among co-operative efforts in the oil industry, the association has an enviable record, but my experience as your president makes me feel certain that its best years are still to come."

None of the regular sessions of the convention were given over to the reports of the various trustees of the eight departments of the association, as has been past practice, but these reports were included in a bulletin prepared by the association, called "The Twenty-sixth Annual Report of the National Petroleum Association" and which was handed to each member at the time of registration.

Cost of Heat

At the first session, following the completion of the regular business coming before the association, H. A. Ross, in charge of the co-operative engineering work for 15 refining companies within the association, read his paper "The Refinery Heat Machine, Old and New." It was well received and some interesting discussion followed the delivery of the well prepared paper. A most pertinent question was asked by Mr. Ross as to the cost of heat. "What do you now pay—and what can you afford to pay—for a million heat units wherewith to refine your oil or produce your steam? Do they now cost 40 cents or 60 cents per million? How many do you produce per barrel of crude or the equivalent you run, and what percentage of those produced do you utilize? Remember, please, we are not asking for the cost of fuel: we want the cost of heat." He stated that the profitable conduct of the refinery is largely dependent upon the information.

Dr. G. D. Brandt, Henry L. Doherty & Company, New York, then described the history and development of the tube still, and his personal experiments in securing efficiency of the pipe still unit—including the bubble type fractionating column. Something new in refinery efficiency was presented by Mr. Brandt in his paper as to tube still design, operation, and heat exchanger equipped bubble type fractionating columns. The paper in full is presented elsewhere in this issue. The association tendered Mr. Brandt its thanks for his work and the sharing of his knowledge with those refiners present.

Round Table

The remainder of the session was given over to what was termed a "Free for All" round table discussion. This was led by H. S. Bell, refinery engineer, New York City, and included lively and worth while discussion of manufacturing problems.

Among the edifying papers presented at this time was "Cold Settling," by L. C. Jamieson, followed by a discussion of vacuum distillation by Dr. Brandt. D. W. Hovey, Waverly Oil Works, was not present to present his paper, "Modern Distillation," and it was read by H. S. Bell. H. H. Green, Kendall Refining Company, then read MacLean Houston's interesting paper, "Maintaining Production." "Filter House Practice" was the title of an interesting discussion by J. B. Northrup, Ohio Valley Refining Company.

Motors, Fuel and Lubrication

Dr. H. C. Mougey, chief chemist, research laboratory, General Motors Corporation, Detroit, in a very interesting paper, "Motor Developments Affecting Fuel and Lubrication," told the association something of the vast amount of research and exhaustive experimentation carried out by his company, and of the problems confront-

Ninth Annual Meeting of Institute

The Ninth Annual Meeting of the American Petroleum Institute will be held at the Stevens Hotel, Chicago, December 4, 5 and 6th, 1928. It is suggested that room reservations be made early.

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ing the automotive engineer in the matter of automobile design. In conclusion he said: "We have seen how the fuels, oils, engines, and driving conditions are inter-related, and how a recognition by the public of the desirable properties of fuels has resulted in their improvement. Automobile engineers are also working on this same general problem, but since automobiles must operate all over the world on the oil and fuels that are distributed in the different localities, automobile engineers can not go too far in making special designs for special fuels and oils. This means that both industries must work together, and only by this co-operation can best results be obtained." He stressed the two points usually uppermost in the refiners' mind in regard to these matters, namely, that pour test has nothing to do with ease or difficulty of starting, and that only viscosity at starting temperatures, is of importance, and that "mileage" depends entirely upon the B.T.U. value of the motor fuel fed to the motor.

Combustion Engineering

The second session was given over to a group meeting of the Department of Manufacture, discussing co-operative combustion engineering program for the coming year. It was decided to proceed with the work which has been so successful for the past three years, under the direction of H. A. Ross, Warren, Pennsylvania. It is interesting to note that the 15 refineries engaged in this co-operative effort can show from their own reports a saving of fuel amounting to $433,564 over the period since the program was inaugurated in 1926.

Possibilities of co-operative research was discussed pro and con by the session and a resolution offered and carried by the authority of which the association will make a preliminary survey between this and the coming spring meeting to point to the problems most seriously affecting manufacturing costs, etc., and to thus secure the best thought of a large number before proceeding along any definite lines.

Fire Prevention

Thursday afternoon, the convention was given over to attention to problems other than manufacture. Houston Donn, National Petroleum Mutual Fire Insurance Company, read his paper, "Burning History," which was followed by the paper, "Past, Present and Future of the Fire and Safety Marshals," by James H. Herbert, president of the Fire and Safety Marshals of the National Petroleum Association. The association decided to continue the work of the fire marshal's association throughout the coming year after the report of this department's highly gratifying record of its endeavors in past years. The plans call for continuation of the group inspection policy throughout the refining districts where member companies are engaged in refinery operation.

Following this discussion, John D. Gill, Atlantic Refining Company, delivered a highly interesting and instructive talk on "Marketing Practices in the Oil Industry." Norman B. Day, Pennzoil Company of California, could not be present to deliver his paper, "Constructive Marketing," and it was read to the convention by C. L. Suhr, president of the Pennzoil Company. "What Oil Heat Means to the American Home and to the Oil Industry," was the title of an interesting discussion of the oil heating problems, read by E. Earl Newsom, assistant director, Oil Heating Institute. H. W. Ralph followed and closed the session with his paper, "Facts Significant in the Profitable Management of Petroleum Refining and Marketing."

Traffic and Transportation

At the final session of the convention and after the discussion of the reports of the eight departments of the association (which comprised the major portion of the association's printed booklet or Twenty-sixth Annual Report), some highly interesting papers were presented. Willis Crane, traffic attorney, National Petroleum Association, read his paper, dealing with traffic and transportation factors and trends within the industry, under the title "Can the Railroads Hold Their Oil Traffic?" Dr. Joseph E. Pogue, petroleum economist, read a paper admonishing the petroleum industry to employ sound economic principles in its conduct, his topic being, "The Price of Prosperity in the Petroleum Industry."

Fayette B. Dow, general counsel for the National Petroleum Association, brought the program to its close with his message, "The Oil Industry Enters a New Era." Mr. Dow briefly sketched the successful attempts toward co-operative conservation or curtailment of oil production carried out within the industry and with the aid of conservation commissions of the affected states. In concluding his paper Mr. Dow said, in part:

"Intelligent leadership, influenced by a better knowledge of scientific facts, and recognizing the force of economic compulsion, has brought the oil industry, not to the verge of regulation, but certainly to an era in which government and business have joined forces to work out this problem of practical conservation.

"There is no desire on our part to predict the future events of this new era. Assuming a legal sanction for the necessary co-operation between units in the industry or resort, as at present, to restriction of drilling by the order of a state commission, there will clearly be required in the industry a high order of economic leadership, involving a vision of the welfare of the whole industry and consistent regard for the public interest. But we do venture to predict that there will be less fear of the part to be played by federal and state governments in protecting the welfare of the industry and of the public. If events bring about an increase of official authority it will be found that the industry, by a straightforward presentation of its facts can protect itself and secure a sound, stable prosperity."

Early in the convention's business sessions it was decided to amend its constitution to provide for the admission of three more trustees, increasing the number from 12 to 15. The election of trustees by the association effected the reappointment of the 12 men serving in these capacities throughout the past year.

The trustees serving the coming year, who also served last year, are as follows: H. H. Greene, Kendall Refining Company; Fred G. Clark, Fred G. Clark Company; Sheldon Clark, Sinclair Refining Company; Frank B. Fretter, National Refining Company; H. A. Logan, United Refining Company; E. M. Lyons, Tiona Refining Company; T. J. Hilliard, Waverly Oil Works Company; O. P. Kenney, O. P. Kenney Company; A. W. Scott, Empire Oil Company; P. S. Tarbox, Independent Refining Company; R. A. Wotowich, Empire Refineries, and G. C. Davidson, Tri-State Refining Company. The three added trustees elected to serve during the coming year are: W. T. Halloday, Standard Oil Com-

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pany of Ohio; N. H. Weber, Pure Oil Company, and Earl M. Craig, Freedom Oil Works Company.

Officers elected to serve during the coming year are: E. M. Lyons, Tiona Refining Company, president; P. S. Tarbox, Independent Refining Company, first vice-president; N. H. Weber, Pure Oil Company, second vice-president; Fayette B. Dow, Washington, general counsel; C. D. Chamberlain, advisory counsel; Willis Crane, traffic attorney; Herbert C. Eaton, recording secretary, and G. B. Hunter, treasurer.

More than 150 members and their wives attended the annual banquet of the National Petroleum Association at the Traymore Hotel, Thursday night. Immediately following the banquet those in attendance were entertained by one of the trustees, who requests that his name be withheld, at a theatre party.

The Refinery Heat Machine—Old and New

By H. A. ROSS
Combustion Engineer.

A CELEBRATED humorist was asked to give a definition of steam. His reply was, "water gone crazy with the heat." Probably his conception of heat effect is not in agreement with yours. Perhaps you unconsciously think of it as a sensation that produces the burn and blister phenomena. In the processes of oil refining you may consider it a necessary evil, but whatever the individual opinion may be, we can all agree that we annually spend large sums of money for its production.

Can you agree as definitely whether 10 or 50 per cent of the money you spend to produce heat is wasted? It your heat cost to refine a barrel of crude oil, or any fractions thereof, greater or less this year than last year? Many such questions might be asked and result in nothing of definite value, for in most instances we find that the refiner has only a vague idea of this very important matter.

Many brilliant minds are now concentrated upon this big problem of heat production and utilization, and concurrently with this convention, the second national fuels meeting, with the foremost fuel technologists of the world in attendance, is in session at Cleveland, Ohio, endeavoring to find the solution to some of your heat problems and assist you to reduce the cost of its production.

The pioneer attempt to refine petroleum was undertaken with the application of heat. Today we follow this same procedure and so far as we now know, will continue to do so in the future. The methods of heat production and utilization, however, have undergone many radical changes, particularly within the past five years, and it would be a wise man indeed who could predict the time when we will attain the ultimate of improvement in this respect.

In order that you may better understand some important facts pertaining to your expenditure for heat, I ask you to consider "The Refinery Heat Machine." This apparatus is a combination of furnace to generate and vessel to absorb heat, commonly called a boiler or still. There are many designs and arrangements of such apparatus, but despite the fact that certain fundamental physical laws must be adhered to in order to produce and use heat economically, individual opinion in many instances seems to have disregarded these rules to such an extent that heavy loss becomes a daily occurrence.

What is Heat?

Heat as we produce it, is an energy which has its origin in matter of some form or other. If you were to ask the physicist just what it is he can only tell you of its effects and manifestations, or that it is a weightless fluid called a "caloric."

Now it most certainly requires some imagination to visualize a fluid that does not have substance, dimension or weight, yet it will flow from one body to another just so long as a small difference in temperature exists between them. Perhaps we may more readily understand this with the aid of the following illustration, using for example a solid fuel such as coal, which we will call matter. This coal is a given quantity of substance having the characteristics of dimension, form and weight, all of which are measurable. We introduce the coal matter into a furnace of burning fuel located under a boiler or still! In a short time it has vanished and all that remains is a few ashes. The involved process of combustion has transformed the solid coal matter into an energy which has flowed from the hot fuel bed to the liquid in the boiler or still, and the only evidence we have of this transformation is an increase in temperature or pressure in the vessel, but not one ounce of weight has been added thereto.

We may now understand the statement that heat of itself has no substance or weight, therefore it cannot be measured, its manifestation or effect can be. It is not a liquid, yet it can flow as a fluid by the aid of some "media." This may be air, gas, liquid, vapor or other substance, and dependent upon the manner in which we control this heat carrying vehicle, will be found an appreciable percentage of the cost to refine crude oil.

Heat Manipulation

Oil refining in reality is a multiplicity of problems in "Heat Manipulation" and practically every paper pertaining to manufacture that will be presented at this convention or that you ever have read or heard elsewhere will be found rooted and grounded in some phase of temperature effect which in the last analysis is heat.

Formerly fuel, regardless of its character, could be purchased for a song and any refiner could afford to waste it as he pleased. Today an entirely different situation exists and it is now of utmost importance that we forget the old shop-worn "Faith of the Fathers" that winked at the indiscriminate waste of material and labor because it was cheap and easily obtained.

May I digress here a moment to illustrate how cheap that most valuable fuel, natural gas was by quoting George P. Brockway, president of the Seneca Oil Works, Warren, Pennsylvania? Mr. Brockway said that some years ago his company purchased natural gas at a fixed rate of six cents per barrel of crude that they ran. During those early days they used from 3500 to 4000 barrels per month. One month they did not run

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any crude whatever, but were very busy rerunning and filtering accumulated stocks. Nevertheless, inasmuch as they did not run any crude they were not required to pay for the fuel they burned.

Such fuel as natural gas requires a minimum of excess air to support combustion, so that the resulting volume of hot gases produced by its combustion is probably only 20 or 25 per cent. of those that would be produced from an equivalent quantity of coal. The early design of the gas fired furnace was a very simple one that afforded but little space for combustion. Evidently no one knew a single fact about the radiant effect of a luminous substance or a flame, and the convective and velocity effect of its hot gases insofar as they pertained to the transfer of heat. Thus in almost every instance furnace heights of 18 inches, or at the most not to exceed 24 inches, were usually provided. Even today there are a number of such boilers and stills in operation.

As a direct result of the universal waste of natural gas, not only in the industries but the household as well, the unlimited supply of this fuel was curtailed and its cost for manufacturing purposes has become prohibitive in all but a few isolated localities, or for special processes.

Faced with the necessity to substitute other fuels for gas, the refiner turned to oil and burned such fractions as were not readily salable. This procedure did not occasion any particular hardship, either, so far as cost was concerned. Furthermore, it was still possible to burn the oil after a fashion in the same old gas fired furnaces, because it likewise required a minimum of air for combustion.

Coal

The fuel situation has again changed in the eastern field, so that now the refiner finds such a demand and a price for his low grade fuel oils that he can no longer afford to burn them, but must have recourse to coal as the source of his heat requirements. In many instances when the refiner turned to coal as a cheaper fuel, the only change that was made in the gas fired furnace was to install a set of grate bars to hold the coal. Right here is probably where a heavy fuel loss occurs, for if we will use a little thought we must know that in order to obtain a suitable combustion condition which will produce a maximum of heat, different methods of air admixture are necessary for the various fuels used, and modified furnace design is essential.

Now the thing of vital importance in any heat analysis is the one big problem of cost.

It costs money to generate heat!

It costs money to conserve heat!

It costs money to utilize heat!

It costs money to reclaim heat!

If we invest a dollar to improve any of these conditions, the improvement we made must return the dollar we spend within a reasonable time, in order avoid investment loss.

As an illustration, if Refinery A consumes 100 pounds of coal at a cost of $4.00 per ton laid down, to fractionate and finish a barrel of crude, the fuel cost will be 20 cents, based on the crude run. We will say that Refinery B only uses 50 pounds of coal to process this same crude. Then the fuel cost in Refinery A 10 cents more per barrel than in B. Refinery B., however, has new boiler and still equipment and we would naturally expect more efficient results from this modern plant than we would from the older one. We therefore assume that the modern equipment affords a distinct manufacturing advantage. Such a surmise might be incorrect, for we frequently find that regardless of the old equipment handicap, a refinery is able in some way or other to hold a place in the competition for business and make a profit, and we wonder why. The following may afford a reasonable and logical answer.

The cost of fuel is not the cost of heat, any more than the cost of crude is the cost of finished product. To either of these basic materials must be added the cost of process, represented by labor, replacement, depreciation, obsolesence, interest, etc.

We actually process fuel to manufacture heat, now what about the quality of the heat? For instance, we say that it costs 40 cents to produce 1000 pounds of steam. If we were asked what kind or quality of steam, we might say saturated or superheated as the case might be, and yet not answer the question. What we must know is how many calories or B. t. u. the steam contains. Dependent upon the pressure and superheat, this 1000 pounds of steam may contain one million and a quarter, or it could hold one million and a half or more heat units. The cost then of a given quantity of steam, as such, can mean but little, for it is nothing but a vapor that carries or transfers heat.

You will recall a statement made in the opening paragraphs that heat can only flow by the aid of some "media" such as vapor, gas, liquid, etc. The quantity of heat which any of these elements can absorb and contain will be dependent upon their physical characteristics, boiling points and specific heats. If we carry the illustration a little further we could say that 1000 pounds of a given oil or gas can carry 100,000 or 500,000 B. t. u.

We know that a certain number of B. t. u. are required for the primary dry distillation of a barrel of given crude to a given bottom. We also know just as certainly how much heat is required to produce the different fractions. Regardless of the mechanical condition of any refineries' heat machines, and whether they are efficient or not, every barrel of finished oil represents the expenditure of a definite number of heat units, no more and no less. Ten times the necessary amount may have been produced and lost elsewhere, but the heat units supplied to that barrel of finished oil cost a certain amount of money per thousand or million to produce them, as you choose to consider.

Here then are the two central thoughts of the "Refinery Heat Machine" problem. First, the cost to produce the heat unit and then the cost to conserve and utilize it, which we will now consider.

It was stated that fuel cost in Refinery A was 10 cents more per barrel than Refinery B. It does not follow, however, that the units of heat produced cost more just because the fuel cost was greater. A volume pertaining to such facts might well be written, but in this presentation we can only consider a few of the more important ones.

Admitting that A's equipment is old, did you ever stop to consider that his investment in heat machines has been either directly or automatically charged off years ago and that now, only the expense of a few simple repairs exists in order to continue the useful life of the machine? Assume that the investment has not yet paid out, have you given thought to the fact that this original investment in heat equipment did not cost one-half of what it would to replace it today? Possibly this refiner has withstood the solicitations of high pressure salesmanship that endeavored to saddle him with heavy investment in equipment that was already obsolete or nearly so—we have records of such cases a plenty. Possibly he has judiciously made a few small investments in order to conserve the heat he has inefficiently produced. Another factor of greatest importance is that perhaps he has employed superintendents, foremen, and other assistants who really do know their business in every particular and who maintain records of daily operations, so that they may at all times have available comparative information of their economic figures for accounting purposes.

We have hundreds of cylindrical stills that are producing premium lubricants by the batch or continuous method. Some

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of these stills are set over modern stoker fired furnaces and are equipped with vapor heat exchangers. The rate of heat transfer in this type of still has also been greatly improved by mechanically increasing the circulation of the oil. The net result of these improvements has increased the overall heat efficiency of the units 100 per cent and more, and in this accomplishment heavy investment has been avoided.

The modern heat machine in Refinery B may be a most efficient apparatus from a mechanical standpoint and yet it may not produce cheap units of heat.

Take for example a boiler plant. Do you know that you can spend $75, per boiler-horse-power for a new plant, or you can spend $150 or more for the same purpose and yet the low cost plant will produce the same heat units just as efficiently with the same fuel as must be burned in the higher cost plant? Furthermore, the expense for skilled attendants, maintenance, and repairs, is usually found to be proportionately higher in the ultra modern plant.

Perhaps Refinery B also has a tubular oil heater and fractionating column, or modification of the same, wherewith to process the crude. This fundamentally is also a heat machine and the same arguments submitted in relation to the boiler plant are equally applicable here. Probably such a process of fractionation will not use 30 per cent of the steam nor 50 per cent of the fuel required to operate the cylindrical still. We must also admit that better yields and improved quality, especially of the lubricating fractions, are afforded in many cases.

The modern tubular heater requires that the flow of heat to the tubes, and the velocity of oil flow within them must always be in phase with each other for given products, therefore to keep these values constant it is necessary to burn oil, gas or pulverized fuel. Gas is expensive. Oil is also expensive, and in addition usually requires steam for atomization. It costs money for power and equipment to pulverize fuel. It may be true that as an offset against the cost of such fuels we avoid the added expense of labor to burn coal, but can we balance the heat cost in this manner?

Progress

Now for the final thought in this connection. Modern fractionating equipment requires a heavy investment of money, and the question is, how soon must this money be returned? Dependent upon the anwser will be found the cost of the heat units produced and utilized. But who can answer such a question at the present time or who knows whether it will be one or ten years before the machine is superseded by a better one.

Do you think that we have reached the limit of attainment in this respect? We have thought so a number of times in the past and more than once seen our fond ideas scrapped for better ones within a year or two. In order to achieve more economy we must progress farther than we have today and you may rest assured that what we now have will also become obsolete, just how soon we cannot predict.

Surely you must know that coal is the most valuable basic raw material we have today. You also know that synthetic oils and motor gases are being commercially produced from such material. Permit me then to present you a brief mental picture of what the future refinery might possibly be.

This refinery may hydrogenate the raw coal and combine the product with its crude oil. The non-condensible gases and coal residue may then be used to produce cheap steam and hot gases for fractionating and processing purposes, and in all probability the entire process from first to last will be done continuously in the one heat machine. How about heat economy with such an apparatus as this?

I would not have you understand that saving fuel alone is the remedy that will afford profit by reduction of your manufacturing costs, although it may represent from 20 to 30 per cent. of the total amount. What I will say, however, is that reducing your cost to produce heat from the raw fuel and then utilizing it properly will assist to a remedy.

No criticism of the modern heat machine, whether boilers, stills, or other heat apparatus, has been attempted in this discussion, either with the intent or purpose of disparagement, for these machines are now apparently affording remarkable economies.

An important matter which we must not lose sight of, however, is the fact that there have been just as many costly mistakes made, with resultant loss, in the development of the modern tubular boiler or oil heater as there was in the pioneer days with the old equipment. Do not forget that the cost of the early error was an insignificant one compared to some of those that are made today.

Assuredly the time has not yet occurred when we are forced to scrap all of our old heat machines for new ones. Pending such a critical situation as that, wouldn't you consider it advisable and also profitable to continue your efforts to still further improve the present heat efficiencies of your old machines by a modest expenditure of money?

In conclusion, I desire to offer a few suggestions relative to the "Heat Machine" that may be of assistance in your choice of the "Old or the New."

The first suggestion is in the form of a few questions. What do you now pay—and what can you afford to pay—for a million heat units wherewith to refine your oil or produce your steam? Do they now cost you 40 cents or 60 cents per million? How many do you produce per barrel of crude or the equivalent you run, and what percentage of those produced do you utilize? Remember please, we are not asking for the cost of fuel; we want the cost of heat. If proper records have not been maintained, it will be a difficult matter to answer the questions correctly or intelligently, and yet the profitable conduct of your plant is largely dependent upon this information.

You are members of the National Petroleum Association and employ skilled men for the specific purpose of protecting your mutual interests and affording you certain information when you need it. In addition to this, many of you are voluntarily contributing services and money to improve the general industrial condition of the individual as well as the organization.

One of the most active committees of your association is the Department of Manufacture. Has it ever occurred to you that this committee might be able to assist you in the solution of some of your heat problems? Under their supervision, a three year study of refinery heat machines has been conducted in a number of plants, and you will find a summary of this work in the current annual report.

This committee now has on file in the engineer's office hundreds of confidential records pertaining to the heat problems and collateral research of not only the small refinery, but the large one as well. In addition to this, related data developed by research committees of several technical societies are regularly received and filed. This is available to you through your manufacturing committee also.

If you want to avoid costly mistakes in heat production and utilization, perhaps your committee can help you. If you want to know what percentage of your heat dollar is now wasted, how much of it you can save and what it will cost you to do so your committee might assist you. If you want to purchase a new Heat Machine or remodel an old one, they have information which you need. If you want to reduce your cost of heat manufacture thousands of dollars a year, they can tell you how. They have done all of these things for others, they have the records and the proof.

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Facts Significant in Profitable Management of Petroleum Refining and Marketing

By HENRY W. RALPH

SOME years ago Herbert Hoover focused public attention on the railroads by stating that they were wasting millions of dollars annually. When you contrast the present day operation of railroads with that of 20 years ago, I think you must agree with me that Mr. Hoover's statement has been proven true.

Public attention will not be focused upon us to the same degree by the next statement that I am going to make, but it is similar to Mr. Hoover's famous statement.

The oil industry of today faces a serious problem. We are wasting millions of dollars annually. We waste it in production; and must therefore waste it in storage; we waste it in transportation; we waste it in the refinery; and finally, and perhaps the most serious waste of all, we waste it in the channels of distribution.

To talk about profitable management is the same thing as to talk about waste. Steps leading to the elimination of waste—waste products, wasted time, useless effort—are the steps we must take to reach our goal of profitable operation.

Not many days ago I had repeated to me some remarks by the head of a fairly good sized oil company. Apart from the context, the gist of his idea was that he did not believe the services rendered by an individual who eliminated a clerk here, and a clerk there, were as valuable as those rendered in enlarging sales, opening a new sales outlet, creating a new product, etc. I am here today to present the opposite view. I believe that there is no more important task to be done in any organization than the continual pruning of detail, the elimination of useless routine, the combination of tasks and the education of individuals to handle such revised tasks.

It is a fine thing to develop additional sales outlets—and it is a fine thing to expand sales through existing outlets—but I can tell you as the result of my own experience that these accomplishments are far easier than to make your selling operations profitable.

It is a fine thing to change your manufacturing operation—to bring out a new product—but it is much easier to do either or both of these things than it is to make a change that is profitable or to bring out a new product that will return profits when it is sold.

It takes intelligence and hard work to expand your business; but it takes much more application to make such expansion earn dividends. Let there come a startling change in manufacturing methods or in distribution and you will hear about it very promptly if you read current trade literature; attend meetings such as these and keep ordinarily well posted.

Little Savings Mount

Let your competitor, however, keep steadily grinding away at slight improvements here and slight improvements there that enable him to do the work that he formerly did with four men with three; and set up now and then a plan whereby some responsible man knows more exactly what his objective is and how he can judge more accurately his success in reaching that objective and you will hear very little about it. The first notice that you may have will be this: that at the end of the operating year he will have a black figure where you have a red; or perhaps an unexpectedly favorable showing. Sometimes even that will be lacking if the statements of earnings are conservative for a year or two. What it all amounts to is this: that on some operation which is essential to the conduct of your business he is earning a slight profit every time he performs it, and you are making a slight loss. The ultimate effect on the balance sheet is determined by the number of times that operation is performed. Did you ever stop to figure how much money it might mean to your company to deliver gasoline to its customers for one-fourth of a cent less than it now costs? It is surprising how much this amounts to in a year.

There is nothing new or particularly startling about these facts. They are pertinent now because they help to emphasize the importance of this subject—facts significant to profitable management of petroleum refining and marketing.

It could be stated with truth that there are no facts developed in the operation of a business which are not significant. If I overlook many that appear particularly significant to some of you it is because the production of those facts has become thoroughly standardized in the operations with which I am familiar and the use made by the organization satisfactory and reasonably automatic. I shall discuss only those which I feel are of definite importance and are not generally used by the petroleum industry.

It must first be stated that significant facts are not of equal significance to all persons. The degree and kind of responsibility which I carry in an organization determine fairly closely what facts are significant to me. If I am a managing vice-president and the director of a corporation, I am interested in a different set of facts than I would be as a stillman, a repairman, a truck driver or a salesman.

Since this is true I have made a grouping of significant facts which is consistent with the usual major divisions of responsibility found in a business organization.

As a Director

As a director I am interested first in the facts which are published periodically—usually once a year and sometimes more often—the facts that are reported on the balance sheet and on the profit and loss statement.

My first glance will probably be to discover the ratio between current assets and liabilities. This might be considered a part of the examination of use made by the organization of such capital as it has—but an unfavorable ratio indicates positively that the organization will not be able to weather a period of depression or unexpected reverses, and it therefore receives attention first. It might be called a "current indicator of the proper utilization of capital."

I am next interested in the trends displayed by the balance sheet. Has there been any change in the sources from which the long time capital comes, and are such changes helpful or otherwise in their effect on the earning of dividend requirements?

What changes have taken place in the investment of capital or in its utilization? Has it been a change which will be help-

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ful? Is it consistent with the trend of the petroleum industry? Has too large a percentage of the capital been frozen by conversion to fixed assets?

What has happened to the surplus account? For explanations of change in this account I must refer to the statement of earnings for the period.

The profit and loss statement shows for the period it covers the volume of sales, the cost of goods sold, the expenses of manufacturing, selling, and overhead; and the resultant profit. Once again it is the trend that has the most significance.

Earning Power

How does the earning power of the business compare for this period with the preceding period—and this is measured by the relation of the operating profit earned to the total capital used.

What is the trend of earnings for each dollar of goods sold? If it has changed, what accounts for the change? Has it been due to changes in selling prices so that we should also develop the trend of earnings per unit sold—or has it been due to a change in the gross margin per unit? What may be expected in the future?

What has been the ratio of turnover of capital this year against last year, in other words, what is the trend of the relationship between the volume of business done and the total capital used?

What has been the relation of expenses to total sales in dollars; and if the price structure is markedly different for the two years, what is the trend of expenses per unit?

Is improvement being made in the rate of turnover of inventories? Is the organization continuously obtaining a larger volume of sales with a smaller proportionate increase of inventories?

What is the trend of collections? Are they slower than last year with the result that the capital is tied up and can not be employed in other channels to increase earnings?

What has been the relationship between the volume of business and the amount of capital invested in fixed plant and equipment for this year as compared with preceding years—and as contrasted with similar companies?

These relationships and others are significant to many others than the directors; but these facts are particularly important to the persons who carry the responsibility of utilizing the funds which are entrusted to them by the stockholders to the best advantage. The responsibility for approving major expenditures for fixed capital assets is almost always a definite responsibility of the board of directors.

Finally, although it has been mentioned before, it is important for me as a director to know what profit has been earned so that I may intelligently vote on the question of dividends to stockholders.

As a chief executive officer, I am particularly interested in the last mentioned fact—the actual profit earned. I am interested in all the other relationships that interest the directors, but my interests are more specific and they involve a knowledge of particular relationships as they apply to individual departments or individual units.

As a general manager I carry the responsibility for the operation of the business. It may be that the particular organization has been poorly conceived; and that its financial problems have not been adequately met; or that something is fundamentally wrong about the location, the manufacturing plant, or the sales organization. Regardless of how they may be changed in the future, it is essential that they shall be handled as competently as possible currently.

If we imagine two opposing armies in positions of equal strength, guided by leaders of equal ability; the armies of the same size and degree of training; one staff having reliable information concerning its own and enemy forces, and the other staff possessed of misleading information, it would not be difficult to foretell the outcome.

Conditions in the business world are similar. The most dependable way to earn maximum profits is to have as many significant facts available as can be currently developed and on the basis of such facts make correct decisions.

Maximum accomplishment is achieved in military operations when the efforts of all units are intelligently co-ordinated. The same principle holds in business

Trained executives, familiar with the details of the business and possessed of adequate information, make plans to reach certain objectives; and then on the basis of those objectives and a knowledge of their own organization they issue the instructions necessary to obtain well-balanced, co-ordinated effort.

In the planning of military operations it is necessary to know certain fundamental facts—such as the result possible of accomplishment by certain military engines, the relative mobility of the various units, the quantities of food, ammunition and other supplies necessary. In the business world it is similarly necessary to know the amount of work that can be done by various units, what amount of flexibility is possible in operation, what supplies and raw materials must be provided. To state it otherwise, it is essential in business, as in military operations, that standards of performance be established and accurately known.

Regardless of size, or the nature of the business, or the industry, it seems to me that there are always three main activities in any organization. One is the preparing of a commodity so it can be sold; another is the selling and delivering that commodity; and the third comprehends the other activities necessary for the proper co-ordination of the first two—particularly those activities that have to do with the market values of raw materials and finished products.

A typical petroleum organization as I visualize it is made up of a refinery and a sales organization. There are three main activities

(a) Manufacturing.

(b) Selling.

(c) Trading—the manipulation of purchases and sales so that without interruption to either manufacturing or selling the results of unfavorable price movements will be of least effect and full advantage will be obtained from favorable price movements.

Getting back to my theme—as a general manager I must know which one of these activities is being conducted successfully and which one is not. Specifically, I must know how much profit is earned by each one of these departments.

It is obvious that the breakdown of an organization profit and loss statement is possible of accomplishment only by the use of some standard of value when raw materials, products in process or finished products are transferred between departments.

As a general manager I must therefore know that there is in existence and in good working order a procedure that establishes currently the value of all commodities that may be transferred from one department to another.

As the first step in the analysis of the failure of a refiner to earn satisfactory profits he must set up some separation of these three activities in his organization—even if he does the buying and selling himself and is in control of the manufacturing. If he is unwilling to do this he will have much less prospect of success in his effort to find out why he is failing to earn profits.

With a knowledge of what profits are earned as a result of

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the three main activities, manufacturing, selling and trading, it seems to me that other facts which are significant to the general manager can best be discussed from the standpoint of facts that are significant to his subordinates—the manager of manufacturing, the manager of selling and the manager of trading.

Manager of the Trading

As the manager of trading I carry the responsibility for accumulating inventories at times of low market prices; and of carrying minimum inventories at times of falling prices. In doing this I must always have a sufficient supply of raw material to keep the manufacturing department going and I must always enable the sales department to meet its commitments.

One significant fact for me is the potential capacity of the plant. This means for each process of the plant.

Another significant fact is the amount of reserve inventory I need for raw materials so that an ordinary delay in the receipt of raw materials will not interfere with the operation of the plant.

I need to have prepared at periodic intervals definite statements of stocks on hand, materials purchased, products sold and definite plans made of operation so that the refinery and the sales department may both operate to the best advantage.

I need to have as good information as can be developed concerning the situation in the United States of stocks, production, imports, exports, consumption. I need any information I can obtain that will help me to estimate future market prices.

It will be seen from the above that the trading department manager is likely to be the general manager himself—or it may be that the responsibility is carried by an executive committee which has as its members the manager of manufacturing, the sales manager and the comptroller. This responsibility for general policies and for genuine co-ordination is the most important responsibility in the organization.

Manufacturing Department

As the manager of the manufacturing department, the first thing I shall want is a computation which shall be current at all times and show the amount of profit that should accrue to my department from the particular plan of running actually in effect; and other computations which will show on the basis of current market prices what would be the best possible combination of products to give maximum profits. Even though the plant can not be operated to give the maximum profit I would insist on this calculation so that I would never lose sight of the type of plant that I should have.

The important thing for me to realize is that it is up to me to produce maximum profits in my department. If at times, because of insufficient equipment or because of sales commitments it is necessary to operate less profitably, I should be able to show why; and to state how mich loss has been incurred by reason of that condition.

In order that I may make calculations of this kind I shall need information on costs as good as can be had consistent with the nature of the business and the plant equipment.

The significant cost figures must be accessible; and the method of assembling these figures must be as simple as it can be, consistent with the auctual process of manufacturing. For any particular operation it is essential that I know what elements of cost vary directly with the throughput; what the fixed charges are for a period of time so that I can determine what effect will be produced by a reduction in the volume of throughput. I should have available the charge per unit that would be adequate if the throughput is normal. For other groups of expenses which will vary according to volume but not in direct proportion to the volume, it is essential that I know what the practical minimum is and the probable maximum volume so that I can determine the effect on final profits of different volumes of throughput.

It is necessary for me, in order that I may plan the best utilization of the facilities of the plant to know exactly what materials are to be received and what shipments are to be made.

All of these facts will at times be very necessary to the general manager, but the manager in charge of manufacturing should be able at all times to state exactly how he stands in relation to his manufacturing schedule and in relation to profit anticipated from his operations.

It is significant to the manager of manufacturing to know that all of his raw materials, products in process and finished products are being satisfactorily accounted for. This gives him an assurance that his responsibility for organization property is being discharged properly and it furnishes him also such basic information as yields of various products, manufacturing losses, stock losses, etc.

It is significant for a refinery manager to know that his various subordinates are being supplied with information which will show them currently how successful they are in reaching their objectives.

It would be possible to carry the discussion of significant information down to the least important position in the refinery, but our space will not permit me to do this. All that we have space for is to outline some general principles covering such significant facts.

Known Facts Are Valuable

Facts are significant to operating individuals in so far as they coincide with the resposibility carried by the individual; and they will become effective in bettering operation when they meet two requirements:

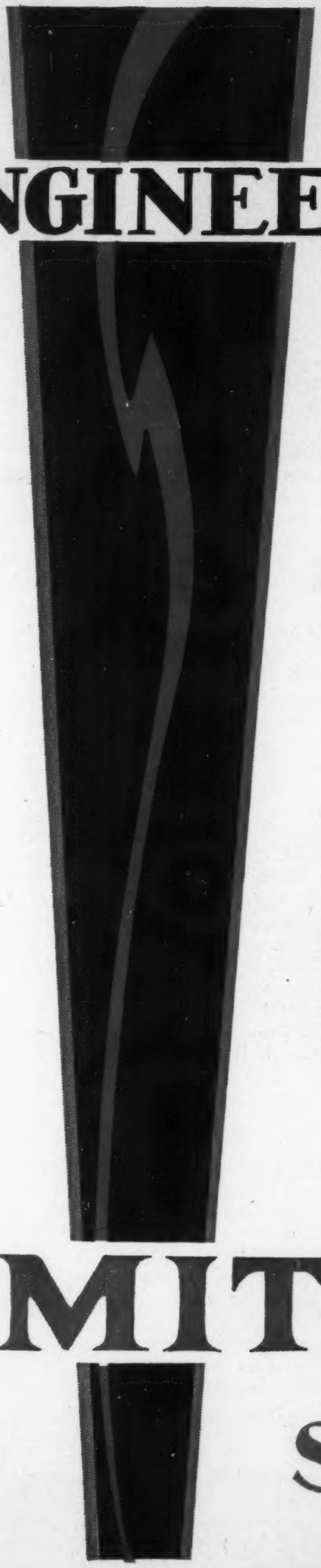
(a) They are presented in a manner consistent with the thought processes of the responsible individual;

(b) They are presented in such a manner that the responsible individual can measure his success in reaching his objective—and he knows that his superior uses them as a criterion in judging his efficiency.

We can be specific to the extent of saying that if a foreman carries a regular gang to perform certain tasks—and can draw on extra help if the regular gang is unable to complete the work—then he will be interested in knowing the fluctuations in his regular gang, the extra help that he utilizes and for what purposes. If he knows that the steam which is utilized in a particular operation is metered he will take an intelligent interest in the use of steam each day. If the fuel which is consumed under his jurisdiction is positively known and the facts of production enable data to be developed covering daily results he will be benefited by having such data developed for him daily. If the work is of such a character that a summary of accomplishment can be made, such as cubic yards excavated, thousands of brick laid, yards of concrete placed, etc., he can be interested in an increase of the efficiency of his gang; or in the reduction of the unit cost.

The above facts which are listed as significant or necessary are all concerned with current operation. They have to do with either planning or operation; and as such are genuinely effective for more efficient performance.

Of no immediate value in operation; and of value only as historical data are the facts of manufacturing costs for previous periods. They do, however, constitute the framework on which all future operation is planned and current operation carried on. They furnish an indispensable check of the accuracy of unit or normal cost figures; and explain the variations from anticipated results. Only as they are accurate



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and informative can the planning work of the executives be efficiently carried on.

Operating Records

Still another kind of record produces significant facts for the manager of manufacturing. I refer to operating records. If we could be sure that each operation would be carried out exactly as ordered; and that the conditions at each processing plant would be in accordance with the best practice, it is conceivable that we could get along without these records. Such, however, is not the case; and it is necessary that we have charts or forms on which will be recorded either continuously or at periodic intervals the temperatures and pressures at critical points in the refinery. We must have some record of the movement of materials and of products; must know how much and what kind of supplies are used; how much steam is produced and how it is utilized; and many other records must be maintained to prove that operations have been conducted in accordance with orders or to show variations from standard conditions.

Let us bear in mind, however, that these records are valuable mainly because they confirm our previous conclusions as to the methods of manufacturing, and because they furnish the explanation of unsatisfactory results. Their accuracy must be unquestioned, because the conclusions drawn from them are used for future planning and current operation. They are, however, historical records from the moment they are made and cannot affect the products that have already been manufactured.

Sales Management

Let us now turn from the manufacturing side to the selling. Let us imagine I am the sales manager.

As a sales manager my problem is to earn a profit in the distribution of goods that are turned over to me at the refinery siding at an agreed price. In this industry the price that can be obtained from the customer is hardly within the control of the sales manager so that my task is that of keeping my cost of selling goods within the margin that exists between the value at the refinery and the price that can be obtained from the customers.

If it is my task to earn a profit operating a far-flung sales organization selling a large number of products, it is obvious that I must have some method of breaking down my operations so that I can concentrate on increasing the profitable portion and either eliminating or improving the unprofitable portion. There are only two methods of making a simple break-down of the sales department operations—and these are by product or by sales units. It is true that some organizations have done both—so they may feel that they can form judgments as to the advantage to be derived from marketing particular products at individual sales units. I have seen such facts produced and I can assure you that instead of being significant they are the opposite—they are misleading—or perhaps a better word to use would be futile.

But little thought is required to discover that an analysis of the results of selling operations should be made in the first instance on the basis of character of selling—and that further break-down should be consistent with the facts in the particular operation of selling. In tank car selling the break-down might be made by lines of products; but in station selling the analysis should be made on the basis of territorial subdivisions rather than by individual products. This is so because in the first place, the costs of selling, delivery and other expenses do not lend themselves satisfactorily to distribution to separate products. Secondly, even on the basis of territorial divisions the problem of a satisfactory accounting for stocks at each point is not economically solvable except by means of some system of classification which is inconsistent with the distribution to separate products. There are certain groups of expenses which bear fairly definite relations to the movement of certain classes of products and these are discussed later.

From the standpaint of significant facts, the operations of a selling organization is materially different from the refinery. There is much less flexibility of current control. There are many points at which individuals of comparatively minor importance operate with a minimum of supervision. There is a definite seasonal activity. The personnel remains fairly constant from month to month at each point. There is no opportunity for the frequent preparation of facts which can be promptly promulgated to responsible individuals. The most significant facts which can be developed from the standpoint of criticism and planning for improvement come from the analysis of activities of a number of similar units.

Each particular sales unit will have its own local investment situation, its own tax condition, its own particular freight rates, its own personnel.

Earnings of Sales Units

The most significant fact which can be developed from the standpoint of the sales manager is the actual earning of each sales unit. He knows that if the earnings have been consistently satisfactory that they are likely to continue so; and if they have been unsatisfactory some drastic change in operation is necessary to correct the condition.

Earnings, however, are very much dependent on the margin that exists between the value of gasoline at the point of shipment in tank cars and the price obtainable from the customer. Some way should be found to eliminate the effect of this important variable. This may be done by subtracting from the profit of the unit the amount of the gasoline margin; and then dividing this difference by the number of gallons of gasoline sold. This rate has been given the designation "gasoline net spread per gallon necessary to break even" and it constitutes for the period in question an accurate measure of operating efficiency.

This rate can be calculated for each month, and for the fiscal year to date. Calculated on the basis of a 12-month moving average it becomes an indicator of unusual value—and is a much more accurate measure of operating efficiency than the amount of earnings.

In the operation of bulk stations, delivery expenses is the most important group of expenses—and the relationship of this group to the total deliveries of gasoline and kerosene is significant. This relationship is based on the assumption of an insignificant volume of other products. If this is not the case, adjustment must be made for the unusual condition.

In the selling of motor oils and greases the direct selling expenses are likely to be very high and the relationship of those expenses to the volume of these products sold is very significant.

Apart from these two groups of expenses there are a large number of expenses which are general in character and the relation of these to the total volume of sales in dollars, or to a weighted gallonage figure, is important from the standpoint of criticising the expenses or the volume moved through individual units.

From a properly designed "analysis of profit and loss statement" for sales units it will also be possible to develop other significant facts—whether products have been sold at standard prices; whether excessive allowances have been made to customers; whether packages have been conserved.

For the field sales force—as for the refinery—it is possible to outline for each typical position the type of information

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that is particularly significant, but there is insufficient space to do this. I must confine myself to generalities again.

For a typical petroleum sales organization the expenses, with the exception of commissions on sales and direct delivery expenses, are not subject to much variation. The problem is then one of obtaining sufficient volume to absorb the expenses, unless a realignment is made of the local personnel.

Speaking generally, the most significant fact that can be impressed on an individual field salesman—whether he be a truck driver, a filling station attendant or an oil salesman—is that he has been given an intelligently developed quota; and he will be held responsible for his quota—with all that implies.

Ultimate success in distribution will be achieved when the field force has been educated to know exactly what objective they should reach in the future and make consistent plans to do so. Even such an item as the daily work of a tank truck driver should receive this kind of attention. A definite effort to build up a route that takes full advantage of the best highways so that the maximum gallonage may be obtained with the least time and travel of the truck will always be more effective than a haphazard effort to obtain such gallonage as the driver's fancy may dictate.

How, gentlemen, you can develop with the minimum effort and maximum speed the facts which I have outlined as significant is a problem for your organization to solve—particularly your accounting department. How, subsequently, you can educate your operating force to make the best use of such information as is developed is a problem of management.

If the remarks which I have made shall prove to be of any service to the industry in meeting its problems I shall be more than repaid for my effort.

Modern Distillation

By D. W. HOVEY
Waverly Oil Works Company.

THERE has been such a decided improvement in the method of distilling that when I was asked by Mr. Bell to write this paper on distillation I was rather at a loss as to just what distilling means and the scope this one word would allow me to cover.

My first introduction to distilling covered merely the heating of the petroleum oil in almost any kind of a still, ranging from the cheese box type to the cylindrical, with very little thought given to fractionation after sufficient heat had been applied to vaporize liquid charged to these batch stills. We then ran into considerable experimentation with towers or aerial condensers, and when we had a three cut air cooled tower taking off light, intermediate and heavy streams on batch coke stills charging crude we thought we had a really flexible and efficient tower.

That this tower was a big improvement there was no question, and was of particular advantage in forming the wax crystals making a pressable wax distillate from Mid-Continent crude oil without any rerunning. It was discovered in the use of this tower that manipulation of the heavy and intermediate streams by returning certain portions back to the still for rerunning was an absolute control of the pressing quality of the wax distillate. These towers are still in use on batch stills and with the batch method of operating are undoubtedly giving good service, however, the rerunning cost of the batch distillation is excessive.

The rapid strides now being made both in furnace design and fractionating equipment are fast making obsolete the old methods of distilling, and the general tendency today is for continuous pipe still operation with efficient fractionating equipment of the bubble tower type. One of our first changes to continuous crude distilling was with a battery of old shell stills formerly used for batch operation. With a battery of six shell stills of various sizes and shapes with no fractionating equipment other than ordinary vapor pipe the crude throughput was increased over three times the amount formerly put through on the batch operation, and in addition the amount of rerun was reduced by more than half.

Today we approach distilling from an engineering and scientific standpoint, and are first concerned with the design of the furnace, which is now approached from a B. T. U. standpoint, which in the past was almost unheard of. We demand the type of furnace which will burn the fuel in the most efficient manner and transmit this heat to the oil with the least possible loss. The radiant heat and recirculating type of furnace have already made a material saving in fuel consumption.

The engineer now designs the furnace, calculating the number of square feet of heating surface required for a given amount of oil to be heated to the required temperature. The fractionating equipment to be added to the pipe still is probably the most important feature and allows many heat saving and controlling devices.

We now have for example a cracking still which through the addition of crude fractionating equipment distills off all of the natural gasoline and kerosene contained in the crude and supplies 100 per cent charge to the cracking equipment, entirely from what would otherwise be wasted heat from cracking.

The flash tower or evaporator tower and the fractionating tower of the cracking unit were duplicated for the crude distillation partially controlling the temperature of the cracking towers by pumping the crude oil through closed coils in cracking towers and discharging into first tower or flash tower of the crude oil fractionating equipment. Super-heated exhaust steam is used in this tower and the desired cuts of gasoline, naphtha and kerosene are taken from the fractionating tower which strips the crude of all the natural gasoline, naphtha and kerosene, leaving the hot topped crude ready for charging to the cracking still.

Corrosion Troubles

In running this type of equipment on one crude oil we developed very serious corrosion troubles and salt deposits in the cracking tubes, which made the cracking of this topped crude very dangerous, and resulted in a rather novel hook-up of the cracking furnace to overcome this trouble. We knew of no practical way to eliminate this salt condition from the topped crude in a continuous operation and it was decided to distill off the gas oil from the topped crude, charging gas oil only to the cracking tubes.

We had but one furnace to do this in which required this one cracking furnace be a combination pipe still for topping crude and cracking still for cracking the gas oil produced from the same furnace. The type of furnace we were using was the carbo-

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FRICTIONLESS—Because the diameter of the opening through the return bend is exactly the same as the inside diameter of the tube.

There are no square corners or abrupt changes in the direction of the oil flow. From the time the oil enters from one tube through until it leaves by the other, there is nothing to retard the steady unbroken flow. Consequently, turbulence is reduced to a minimum and that enemy of efficiency—pressure drop—is practically eliminated.

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rundum type radiant heat. We disconnected the convection bank of tubes and charged the topped crude from the crude evaporator tower to the convection bank of tubes and then to the evaporator tower of the cracking unit, picking up enough heat in the convection bank of tubes, and additional heat from evaporator tower, to reduce the topped crude to a heavy fuel oil of about 14 gravity, distilling the gas oil overhead from the evaporator tower and picking up same in the bottom of the fractionating tower and then pumping with hot oil pumps from mixing tank through the cracking coils.

In order to maintain uniform velocity through the cracking coils it was necessary to maintain a uniform level of gas oil in the mixing tank, which at times required the addition of gas oil from other source and at times it was possible to withdraw some of this gas oil back to storage. I would hardly call this a fool proof operation as it requires rather delicate balance to distill off from the back end of the furnace enough gas oil to supply the front end. However, we were successful in keeping this in operation for considerable length of time while building a separate pipe still to replace the split furnace we were using and this experience is merely given as an illustration of the flexibility of the present distilling equipment when emergencies arise requiring opration somewhat off the beaten path.

In addition to the design of the furnace, fractionating equipment, etc., there is always the chemical characteristics of the crude itself to be considered, particularly from corrosion standpoint as in the case of the crude mentioned above. We had with this one crude a plugging of the crude preheating coils which was apparently due to the salt and some emulsion peculiar only to this particular crude, which we have not had when operating with other crudes. That this was partially if not entirely due to the salt content is borne out by the fact that after these coils were plugged, washing out with water would entirely remove this condition, and on further experimenting we discovered that the addition of varying amounts of caustic would also prevent collection of any deposit in the coils, and in fact we have demoved this during the operation by using excessive amounts of caustic for a short time. The use of caustic, incidentally, forced us to discontinue the use of aluminum gaskets which were entirely replaced with steel gaskets. From this same crude oil corrosion troubles were very excessive in the tubular type of gasoline condenser we were using, and in order to overcome this ammonia was injected in the fractionating tower and in the vapor outlet.

Use of Chemicals

The use of chemicals to counteract corrosion naturally governs the metals used in construction of condensing equipment, etc. The use of ammonia in the one case preventing use of tubes made of copper bearing metal which we have found resists corrosion in similar type of condenser much more than the steel tubes we were compelled to use.

The development of fractionating equipment has undoubtedly been the most important and greatest boon to the distilling end of the refining industry. The present day bubble type tower not only eliminates rerunning but absolutely controls the distillation range of the products taken off.

Many technical papers have been published covering detailed construction and operation of bubble type towers and also arguments for and against "these towers versus packed towers," together with data as to results from various shapes and sizes of bubble caps, spacing of trays, etc., which is in itself a subject of interest in deciding on actual construction.

The important fact remains that we have today distillation equipment, which, with the development of furnace and fractionating equipment, will not only in one operation distill and fractionate all of the products contained in the crude oil, but will do this in a very limited area. As for example, we have on a ground space of 125 x 140 feet equipment which will distill, crack, fractionate and treat into finished products approximately 3000 barrels of crude oil per day. This as compared with equipment necessary and space required a few years ago will illustrate the enormous strides made in the distillation of crude oil.

While the above covers briefly the distillation of crude oil for recovery of lighter products only similar strides have been and are being made in the distillation of crude oil for production of lubricating oils, and while the pipe still and fractionating equipment are more or less the same, vacuum is applied as against pressure for production of the lighter ends. While there has been considerable development of continuous vacuum distillation for lubricating oils this has not been as complete as for the lighter ends, and while continuous operation is now successful with some crudes, there is no doubt in my mind that this will very quickly be developed for practical use with all grades of crude oil.

Pipe Stills

By D. G. BRANDT
Henry L. Dougherty & Company.

DEVELOPMENT of refinery equipment in the past 10 years has been almost as rapid and varied as the equipment of an all electric radio set and the various hook ups are almost as complicated. We no sooner get an installation made until we begin to change this or that to improve the operation or efficiency. Although our present equipment is fairly efficient, the refiner must realize that he must continually keep modifying his equipment to operate on the ever changing crude supply and supply products to specifications which are becoming more exacting every day.

In so much as the distilling equipment is the heart of a refinery; it has been the target of much research and development. This apparatus has passed through many stages, from the old cheese box and cylinder stills operating batch with no towers, then connected together for continuous operation, then the addition of towers and later with pipe still pre-heaters. Much could be said about this type of apparatus but I believe the industry as a whole has accepted the pipe still heater and tower fractionator as the last word in distilling equipment. The arrangement and number of such pipe stills and towers for complete distillation is a problem which will have to be solved by the engineers for each individual case. At the present time there is no complete distilling unit that can be universally adapted.

The fractionating towers used today are similar to those used in alcohol and benzol fractionation and much of the tower design had already been worked out. The refinery engineer merely had to modify the designs to his needs.

Development of Pipe Still

This was not true of the pipe still heater, and this part of the unit had to be designed and built from very meager data. These

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From an article by C. O. Willson in
The Oil and Gas Journal, July 19, 1928

"Regardless of the past there are those among the refining fraternity who see in the changed conditions of the past few months the beginning of a new era for the manufacturing end of the oil industry in which the refiners with *flexible* equipment will be able to adjust their operations in line with general market conditions and end the yearly periods on the profit side."

What equipment in your refinery could be more flexible than the Dubbs Cracking Process?

With the flashing system it produces a maximum of premi-

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heaters were originally constructed with ordinary lapweld pipe set in a brick box. The tube bundle was set directly over the combustion chamber, which was usually too small for the quantity of fuel burned. The result was burned out tubes from flame impingement, overheating and oxidation. Dutch ovens were then added to these heaters which reduced the tube failures, but they were still unsatisfactory. During this period the use and control of radiant heat absorption was not known and the designer was always trying to get his tubes farther away from the combustion chamber, as all of the tube failure was laid to flame impingement and small combustion space. To overcome this the tube bundle was placed alongside the fire box and the flue gases passed downward over them. This also allowed the operator to pass the oil upward through the tubes, counter current to the flue gases, and increase the efficiency of the heater. This heater worked fairly satisfactorily so long as the fire box temperature was kept low by the use of excess air. The efficiency of these heaters were low and the oxidation of the top tubes rapid and tube failures frequent. It was very apparent in these heaters that the arch and back wall of the heater reflected considerable heat to the top tubes and in order to reduce this, tubes were installed directly above the tube bundle and up the back wall to absorb this heat reflected from the fire box. The hot flue gases from the fire then entered a space that was surrounded on three sides by tubes and little or no tube trouble was experienced if the fire box temperature was held below 1800 degrees. The efficiency of these heaters was still low, and when used with a high oil inlet, temperature ran about 40 per cent.

Up to this time we were not concerned very much about the efficiency, as this was better than that of the old cylindrical still, and we felt the B.T.U. transfer rate was high, as indicated by the number of tube failures. However, now having a unit which operated satisfactorily from a mechanical and maintenance standpoint, we made a complete engineering survey, checking the B.T.U. transfer for each row tubes. To our surprise we found the transfer rate very low for the tubes in the bundle and particularly so in the bottom rows; while the tubes in the roof and up the back wall above the bundle were doing more work than the tubes of the bundle, with the exception of the top row. About this time considerable work was being done on the absorption of radiant heat in connection with steam generation for power plants, which checked the results of our findings.

Redesigned Heaters

We then redesigned our heaters to take advantage of all the data obtained by the engineering survey. In this design we extended the roof tubes over the entire roof and up the back wall above the tube bundles, and insomuch as these heaters were to work on cracking equipment having an inlet oil temperature of 750 degrees, we used air preheaters to preheat the air for combustion and recirculated the flue gases back into the fire box to reduce the fire box temperature and increase the gas velocity and temperature difference over the tube bundle. With these additions we were able to reduce the excess air to a minimum and equalize the work done over the entire heating surface, which materially increased the capacity per square foot heating surface over previous designs.

These heaters operate with a fire box temperature of 1400 degrees and a stack temperature of 375 degrees, with an oil inlet temperature of 750 degrees. The flue gas analysis will compare with that of good boiler practice, and the thermal efficiency under test conditions is about 80 per cent.

All air for combustion is supplied by electric driven fans and the pressure in the fire box is slightly above atmospheric pressure. The amount of flue gas recirculated can be varied either by damper control or by the speed of the hot fan, thus putting the fire box temperature under the control of the operator.

Later developments of this heater have been to again increase the radiant absorption surface by using a thin diaphragm to separate the tube bundle from the combustion chamber, or installing a baffle behind the first row next to the combustion chamber. Other modifications are to lengthen the flame travel before adding the recirculation gases and rearrangement of ducts and hot fans.

In all of our designs we do not attempt to drive our radiant absorption tubes at a high rate by carrying high fire box temperature, but work all tubes at a moderate rate. This allows the operator to raise or lower the fire box temperature at will, without materially affecting the capacity or efficiency of the heater. This is done by changing the quantity of flue gases circulated and has a great advantage for heaters used on cracking equipment by controlling carbon deposits in the tubes and reducing fire box temperatures at the end of a run. You can readily see that with no flue gas circulation or a fixed flue gas circulation, your fire box temperature will go up as your tubes become dirty and the wall temperature of the tubes become hotter, even to the point of tube failure if the operation is continued.

Types of Heaters

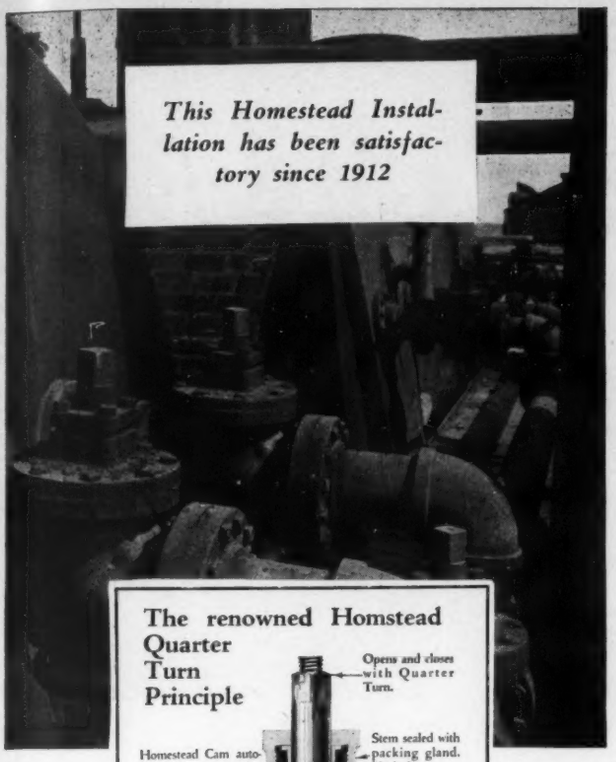
Thus far I have confined my remarks to our own developments and experiences, but at the present time there are several successful and efficient heaters available to the industry. These heaters have been classified as open radiant; shielded radiant and recirculation. From my observation, either the open radiant or shielded radiant types are very satisfactory when used where the oil inlet temperature is low, or where only a moderate air preheat is used. The recirculation heaters are used where high inlet oil temperatures are encountered, and usually in conjunction with air preheaters. In these heaters, fire box control is dependent entirely on the amount of flue gas recirculated, and fans and ducts for handling these gases are extremely large and could be reduced to less than half the size by the addition of radiant absorption tubes in the heater.

You will note that I have referred to the oil inlet temperature of the heater in a number of places and all of our heaters are designed for high inlet oil temperature. If the oil inlet temperature is low, say below 400 degrees, I would not recommend the installation of air preheaters or recirculation as a general rule. This will depend on the cost of fuel and the savings realized from the addition of this equipment. In heaters for such service sufficient radiant absorption tubes can be used to reduce the fire box temperature to a point where it will not be injurious to any of the tubes, provided they are properly arranged.

Inasmuch as the heater is only a part of the distilling unit and supplies only the heat that is now recovered from the process, it becomes of less importance as the efficiency of our heat recovery increases.

Towers Heat Inefficient

The present bubble cap tower, or any fractionating tower, for that matter, is very inefficient from a heat standpoint. Thermally, it is a piece of apparatus which takes heat in at a high temperature and delivers it back to you at a lower temperature and the longer range of products you produce from a single tower the greater the reduction in temperature between the inlet and outlet of the tower. As an illustration, let us take a single tower pipe still unit running on crude to a low percentage bottom and taking off gasoline at the top, and kerosene, gas oil,



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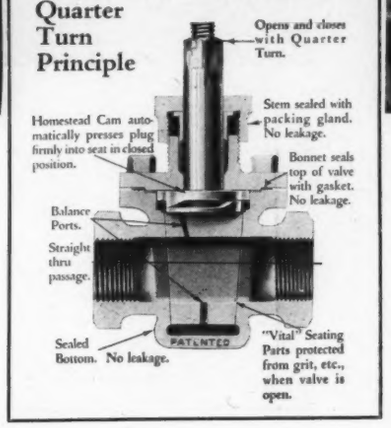
Straightway Cast-Steel Valve for pressures over 350 lbs., temperatures over 400 degrees. For low temperature and low pressure work, this same design is available in Semi-Steel.

The renowned Homstead Quarter Turn Principle


Opens and closes with Quarter Turn.
Stem sealed with packing gland. No leakage.
Homestead Cam automatically presses plug firmly into seat in closed position.
Bonnet seals top of valve with gasket. No leakage.
Balance Ports.
Straight thru passage.
PATENTED
Sealed Bottom. No leakage.
"Vital" Seating Parts protected from grit, etc., when valve is open.

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In an Eastern refinery 42 Homestead valves have been handling the hot tar from a battery of stills for 16 years. The temperature in these low pressure lines ranges from 250° to 500°.

Although such successful service is unusual in refining, in refineries where Homestead Quarter-Turn Valves have been tried it is not an unusual experience. Rather it is typical of the satisfactory results being obtained from the use of Homesteads.

There is a Homestead Valve that will give you the very highest class of service for any specific refining applications. Several Valves have been developed expressely to meet refinery requirements and you may as well profit from our research now and save the cost and trouble of experimenting. Name the toughest service you have. We'll name the valve that will take care of it to your satisfaction.

Homestead makes a special line of valves of rugged construction for jobs where long and continuous service are needed in the refinery. A Homestead Catalog will be sent on request.

Homestead Valve Manufacturing Company, Homestead, Pa.

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THREE WAY
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LUBRICATED TYPE
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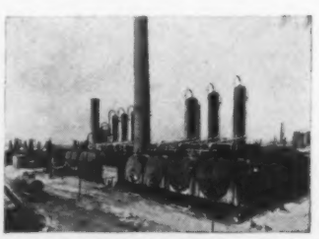
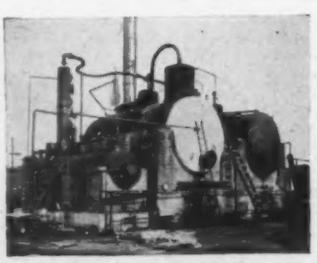
Longer Life *for*

At the refinery of Simms Oil Company, Dallas, Texas, ADAMANT Fire Brick Cement has been used in building the refractory construction in stills and boiler furnaces.

Every time a boiler or still setting is out of service in this refinery, the brickwork is surfaced with an ADAMANT - ADACHROME Mixture, blown on with The ADAMANT Gun (Price $25.00). Brick pores, cracks and joints are sealed, and the brickwork is highly resistant to slags, sulphur and other impurities in fuel which cause fluxing, slagging or melting of brick.

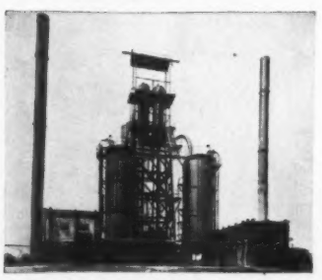


In stills at The Paragon Refining Company, fire brick construction is built with ADAMANT Cement.



In these stills at a mid-western refinery, settings last twice as long since they are built with ADAMANT Cement.

In tube still fire brick construction at Stoll Oil Refining Co., Louisville, Ky., ADAMANT Cement has given very satisfactory service.



On the fire-exposed walls of these Dubbs units in a mid-continent refinery, ADAMANT Cement has been used effectively as a protective coating.

In still settings at Henry H. Cross Company's Smackover refinery, walls are "in much better shape" since ADAMANT Cement is used for laying up the fire brick.

This front wall in a Foster tube still has been given a protective coating of ADAMANT - ADACHROME, applied with The ADAMANT Gun.

Fire Brick Construction

With This New Method of Building and Maintaining Refractory Brickwork In Stills and Boiler Furnaces

GETTING longer service from fire brick construction is merely a matter of building brickwork in the proper manner—and periodically maintaining the refractory construction to curb deterioration and keep the brickwork in continuous good condition. Many refineries are doing it.

Start right—use good fire brick, suited to your conditions. Lay up the brick with ADAMANT, the *original* high temperature cement, which possesses the longest record of service in the petroleum refinery, and has demonstrated its superiority for refinery work over a period of nearly a quarter-century.

With ADAMANT, you can make the thin, brick-to-brick joints so essential to good construction. Joints made with ADAMANT air set, requiring no heat to bond. Yet ADAMANT joints maintain their bond through the complete temperature range, despite rapid heating and cooling. ADAMANT joints protect the edges of the brick, preventing spalling and cracking of brick edges. In addition, ADAMANT joints do not open up in service, for ADAMANT is made almost entirely of pre-calcined materials, and therefore has little shrinkage. Because of the high strength of ADAMANT joints, they prevent creeping or traveling of the brick. Consider how important are these refractory superiorities of ADAMANT for service in the high capacity tubular cracking and topping stills of today!

Brickwork, built initially with ADAMANT as a bond for the fire brick, is unsurpassed in durability and long life. For even greater resistance to destructive elements, coat the finished brickwork with a surfacing of the proper mixture of ADAMANT Cement and ADACHROME, blown on with The ADAMANT Gun. ADACHROME is the chemically neutral Super-Refractory. Pre-mixed with ADAMANT and applied as a coating, ADACHROME provides a dense, highly refractory surfacing and is exceptionally resistant to the attack of flame, fusible coal ash, sulphur in fuel oil or other destructive actions which cause slagging, fluxing or melting of the brick.

At periodic intervals in the life of the fire brick construction, apply other coatings of the proper ADAMANT-ADACHROME Mixture, also blown on by means of The ADAMANT Gun. These additional coatings compensate for normal deterioration of the brickwork, by filling up all brick pores and sealing the joints, building the structure up to its original thickness.

Many refineries are using this money-saving method of building and maintaining refractory construction, and thereby effecting worthwhile savings in refractories expense. May we send you complete data and interesting booklets? Write today.

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Visitors to the International Petroleum Exposition at Tulsa from October 20th to 29th are invited to visit our Booth, No. 123 in the Texas Building.

Our representatives will be glad to explain how the use of ADAMANT Fire Brick Cement, The ADAMANT Gun and the ADAMANT - ADACHROME Mixtures is aiding many prominent refineries to improve refractories service and reduce maintenance expense.

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Remember Booth No. 123 in the Texas Building

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and wax distillates off the side, through stripping sections. The tower will receive the total crude from the pipe still at a temperature between 700 and 800 degrees and deliver gasoline vapors at the top at approximately 325 degrees. The side streams will be withdrawn below their boiling points due to steam striping and we will be required to pump back into the tower sufficient gasoline as reflux, to absorb all the heat of vaporization of all products other than the gasoline and all the sensible heat between the inlet temperature and the temperature at which all products leave the tower. Thus we have an enormous quantity of heat at 325 degrees, which is far in excess of what the crude can absorb in the vapor exchangers. The interchangers on the side streams and bottom can recover some heat, but as a whole, the crude seldom reaches 400 degrees with very little vaporization due to the high pressure on the interchangers.

Interchange Tower

To overcome this disadvantage we have developed what we term an "interchange tower." This tower differs from the straight bubble cap tower in that the crude is passed through interchangers between each bubble tray with a fixed temperature differential between the crude and vapors ascending up the tower. Interposed between the vapor interchangers, the crude is passed through the liquid product interchangers which assist in maintaining the proper thermal gradient. The crude is carried through the interchangers at substantially the same pressure as that in the tower and at a pressure below that of the liquid interchangers. This has a marked advantage over the usual system, as no products are thrown off test by contamination, but any leakage is merely added to the crude and is reprocessed. The theory on which the tower operates is entirely different from the straight bubble cap towers and is operated on fixed temperature gradients between the trays. Although the reflux flows downward through the tower from tray to tray, it increases in quantity as it proceeds down the tower unless taken out by the proportional reflux boxes. The side streams are taken out and handled similar to other towers, except the kerosene is made as an overhead redistilled product. The crude leaving the last interchange has been heated by recovered heat to 500 to 550 degrees and approximately 45 per cent. of the crude has been vaporized. At this point the vapor is separated from the liquid, and the liquid is pumped through the heater and into the separator where the vapors and liquid are separated, and the vapors passed to the base of the tower along with those previously removed from the crude. The bottoms, as well as the side cut products, are pumped up through their individual circuits, and are cooled by the incoming crude. All products, with exception of the kerosene, are cooled to an average temperature of 125 degrees, without the aid of water cooling. The only water coolers used are those on the kerosene and the final gasoline coolers. Both the thermal and fractionating efficiencies are extremely high. The control of the unit is simple and the only automatic equipment necessary is flow controller on the crude supply.

I have given you this short description of some of our distilling equipment to show why all of our heater designs have been for high inlet crude temperature.

Although I previously mentioned that the efficiency of the heater is gradually becoming of less importance as we increase the thermal efficiency of the fractionating equipment, it has always been my aim to make each piece of apparatus as efficient within itself as the economics will permit, and when these are properly connected and synchronized, we have the maximum yields of products at the minimum cost.

Filter House Practice

By J. P. NORTHROP
Ohio Valley Refining Company.

DECOLORIZING of lubricating oils throughout the Pennsylvania refining district involves expenditures of an enormous sum of money, probably exceeding one-third of the entire manufacturing cost of those plants decolorizing the larger proportion of their lubricating oils. Naphtha, steam, labor, investments, depreciation, insurance and losses, all enter into the cost of the finished product.

Losses, in the judgment of the writer, is the largest single factor totalized against the final cost per gallon. These losses are not all traceable to vapor losses of naphtha used in cleansing the clay, considerable losses of the oil occurring being burned up in the kiln from improperly washed and steamed clay. Still other losses occur in reclaiming filter washed or bright stock from the centrifuging or settling edepartment. To prevent these losses every means that could possibly be devised should be utilized. Decolorizing stock in solutions of gasoline for cold settling or centrifuging should be done only in gas tight equipment providing each filter with look boxes so that the operator may determine at a glance just what is taking place at all times. If a gas recovery system is a part of your equipment, by all means connect up to these tanks. All vapors blown from filters when steamed should be carefully condensed before liberating to the air to prevent as much as possible losses from this source and to determine how efficiently the cleansing of your clay is being done, taking an occasional sample of the average of the entire filter to your laboratory. Place six to eight ounces of the clay in an A. S. T. M. distillate flask, in turn connecting this up to your regular A. S. T. M. condenser, heating the clay gradually to distill off any naphtha or oil that may remain in it, basing this back on the number of tons of clay contained in the filter.

I am sure that a poorly washed and steamed filter or those classified as dirty, giving off black smoke when being restored, will give you something to think about. Such a filter often runs from 20 to 40 gallons of oil per ton of clay or more than sufficient to offset any profits you might hope to have from that particular filter. In addition to the losses, the efficiency of the clay will be seriously affected by the carbon which forms in burning up the oil in the kilns. One or two companies manufacturing special kilns today will, aided by the oxygen in the air by introducing this in the clay bed while it is still hot, remove this carbon and restore the clay to approximately its original efficiency, but not with the degree of ease and speed that they can restore cleanly washed clay.

Efficiency of Old Clay

The simplest method that has ever come to the attention of the writer, of determining the efficiency of old clay as com-

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pared to the new, is as follows: Select a small sample eight to ten ounces of new clay which is giving satisfactory results, grinding or pulverizing this until it will all pass through a 100-mesh screen. Follow the same procedure with the sample of the old clay on which you are desirous of determining its efficiency in relation to the new. Fill two small glass vessels with exactly the same amount of oils of the same grade, using not too large a sample (never to exceed a pint, preferably 200 neutral unfiltered) noting carefully the color of the original sample, placing in each container the exact amount of clay, both old and new, by weight, heat to 150 temperature and maintain for 20 minutes, constantly agitating, strain through filter paper, taking the color cuts made by each clay, figuring this back against your original sample, will give you consistent results which cannot be obtained by any other method known to the writer. Just what loss of efficiency should determine the number of times clay can economically be restored is a matter for each individual plant to decide for themselves and depends a great deal on the material and the color to which they are decolorizing as well as the grade and color of the crude from which the material is made. The darker crudes produce proportionally a smaller yield of a given color naturally than will the lighter grades. I, therefore, know of no set rule that can be devised for an average yield per ton of clay adaptable to all plants.

There are many methods in practical operation in soaking and running filters, ranging all the way from filtering under pressure up to 20 pounds per square inch down to pumping the oil up through the bed of clay. Most of these give good results in the particular plants in which they have been perfected. Pressure up to 20 pounds for filtering lubricating oils of a viscous nature, no doubt, are justifiable if for no other reason than the saving of time that can be accomplished both in soaking and running by maintaining a back pressure on the bottom of the filter, channeling will be prevented with its loss of production.

The writer is personally in favor of filtering all oils that possibly can be economically in solutions with as high as 50 to 60 per cent naphtha. Much greater speed can be obtained in running time as well as draining, less naphtha consumed to thoroughly cleanse the clay and yield almost double that obtained on straight 600 stock, enabling you to shorten your recycling period per filter 24 to 48 hours.

Due consideration should be given the contact decolorizing of lubricating oils in at least all new installations of any size. This method having been so perfected at the present time that its cost will compare very favorably with the percolation type of filter even though no attempt is made to restore the powdered clay at all. Operations are more fully under your control, claims are also being made in restoring the fine clays to approximately the original efficiency by special designed kilns which should make this of particular interest to all who are concerned with the cost of discolorizing lubricating oils.

Cold Settling

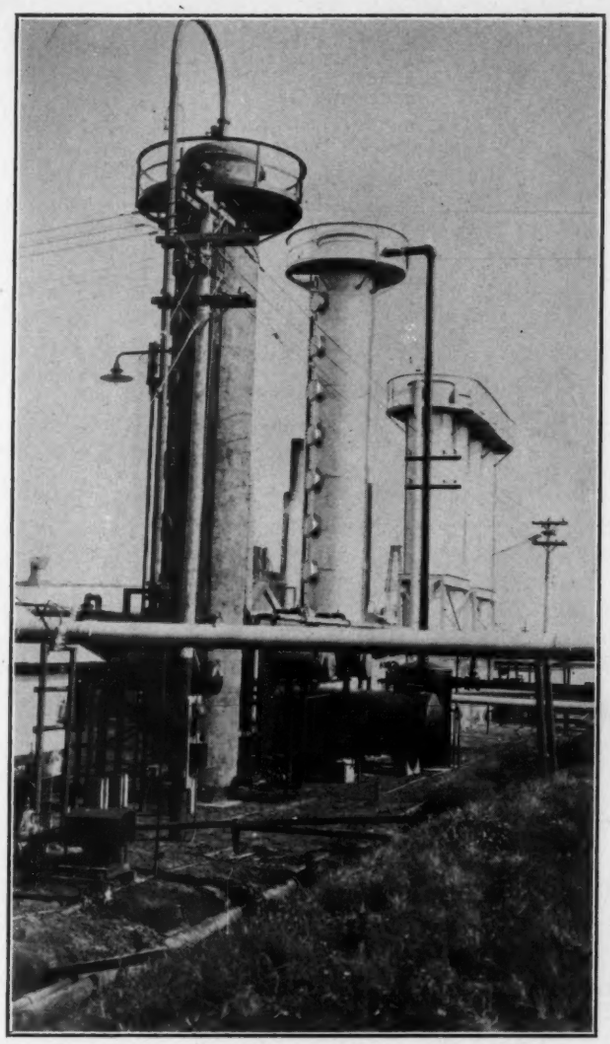
By L. C. JAMIESON
Viking Oil Corporation.

THERE is a tradition that our family really went into the oil refining business because of bright stock. W. D. Todd last year at the annual meeting, in his remininscences of early refiners mentioned that H. A. Jamieson took over the refinery which later became the Warren Refining Company from one of the banks in Warren which had taken it in on a bad debt. The story goes that H. A. Jamieson agreed to take over the plant and operate it for a year; if he liked the business he would purchase it from the bank; if he did not he would turn it back at the end of the year. About that time Tiona crude was very cheap, I believe the year was 1893. As a result several tanks of Tiona crude were stored over winter and the next spring the Warren Refining Company had fine bright stock. The next step was the purchase of the refinery from the bank.

Cold settling of a solution of benzine and Pennsylvania 600 stock settles out amorphous wax and some other impurities which ordinarily would be left in the steam refined stock. However, the resulting bright stock has not been too highly refined by the elimination of too much wax, which seems to have a definite value in motor lubrication.

The old established method of getting rid of these impurities was simply to let nature settle it as first mentioned in our opening paragraph. Theory and practice developed fairly rapidly in a few of the early Pennsylvania refineries. Theoretically a tall narrow tank should be the best as it concentrates the petrolatum bottoms in a narrower circle and hence more of the settled solution, which I shall call "top mix," can be skimmed off. On the other hand a flat broad tank theoretically should settle out quicker as the petrolatum on its way down through the solution would not have so far to travel. In practice we believe that a tank of medium proportions, between these two extremes, gives the best all around results. For instance a 30 x 25 tank of capacity of 3000 barrels is our star settler. The other settlers we have of 1000 barrel capacity, size 20 x 20, do not compare either in chilling time or settling time per gallon received with the larger tank.

There have been many methods and theories tried out in the arrangement of chilling coils in settling tanks. The commonest of course is a simple pipe coil with return bands at either end in one plane near the top of the tank. Refiners have used these coils not only in one plane, but in two planes a few feet apart or even in three planes, having a coil at the top, center and near the bottom of the tank. We have found that the fastest time can be made with coils in two planes, the top one within two or three feet of the top level of the solution and the second plane a few feet under the first one. Other refiners have tried vertical coils which have advantages, one of which we understand is that petrolatum does not freeze so readily on the coils themselves and thus retard the chilling effect of the brine circulating through the coils. In a certain settling tank that the speaker knows of, a very successful use of second hand hotel radiators was achieved. These happened to be large radiators shaped in a right angle, originally around the corner of a room. There were four of them and they were placed in the settling tank and the brine circulated through them. Another successful way of chilling the solution in a settler tank has been to prepare the solution for chilling in one tank, circulate it then through the use of a wax chiller such as you all have in



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your press rooms, by means of which the solution temperature drops to a neighborhood of 30 to 40 degrees, then to fill the ordinary settler with its brine coils direct from the wax chiller and carry on the chilling in the usual way. Others have successfully used the direct expansion of ammonia into the coils of a settler although this method originally caused a lot of trouble through leaky joints.

Good Insulation Pays

Settling tanks of course are insulated and as a general rule good insulation pays for itself. All insulation really is the entrapping of air between other substances as air itself is one of the best insulators known. A successful insulation is had by the use of the old fashioned saw dust that our friends, the ice men use in their ice houses, and the use of saw dust is surprisingly near the finest cork insulation or asbestos proposition which is on the market as far as the efficiency is concerned.

To be successful in settling bright stock the solution should be preheated at least to 90 degrees, to drop out the moisture which may be present in suspension in the solution, either from the gasoline or from the oil. The time tested way of doing this was to fill the settler and then heat the solution by the use of steam coils in the bottom of the tank. A leaky coil however would always cause a great deal of trouble and possibly the best way that the speaker knows of to handle this portion of the process is to pass the mixed solution through a heat exchanger using the exhaust steam from the pumps to heat the solution to the proper temperature. This obviates any but the smallest chance of moisture getting into the solution, is very economical and speeds up the preparation of the settler for the beginning of the brine. The method I speak of is used by us with great success. We have two steam pumps, one for filtered solution and one for straight benzine, equipped with Mason governors. These pump into the same line, are passed through a cylinder with many baffle plates in them and the solution is thus completely mixed, a very important first step in preparing a settler. From the mixing chamber the solution goes to the heat exchanger which was designed to heat 350 barrels of solution an hour to 100 degrees. From the heat exchanger the solution goes direct to the settler leading through the bottom draw offline. The Mason regulators are set to give us the gravity we require and the entrance of exhaust steam into the heat exchanger is handled through a valvue and the temperature reading taken at the outlet of the heat exchanger. Very close control can be had by using this method and we save from six to twelve hours time on each settler, depending on its size, also much benzine evaportion.

There are three cardinal principals to remember in getting ready to start a settler. The first is for the solution to be free from moisture, secondly and perhaps most important of all is to have it thoroughly mixed, and third to bring the contents of the settler between 90 and 100 degrees to drop out the moisture that may be left in it. Of course the settler must be fairly clean and should be kept that way.

We have found that within certain limits the gravity of the solution mix is not important except that if you use too much benzine the percentage of top mix received from the settler is too low. We aim to have our settlers close to 44 gravity using about 26½ gravity steam refined filtered stock and 56/8 gravity benzine around 400 end point as a solution. The gravity is controlled as previously mentioned through the Mason regulated pumps and roughly the percentage is about 60 per cent benzine and 40 per cent filtered stock. It has been our experience that a filtered stock produces less petroleum than using the stock unfiltered.

There are two generally used methods of skimming the top mix from the settling tank. One is by the installation of permanent manifolds on the side of the tank, six to eight inches apart and the other is by the use of swing lines. Both are successful. The first is more expensive to install, but has the advantage that a careless pumper will not drop a swing line and spoil the settler.

There are as many theories about cold settling as there are cold settling plants. We will mention a few that others hold and then I am sure we should be afforded the opportunity of advancing some of our own.

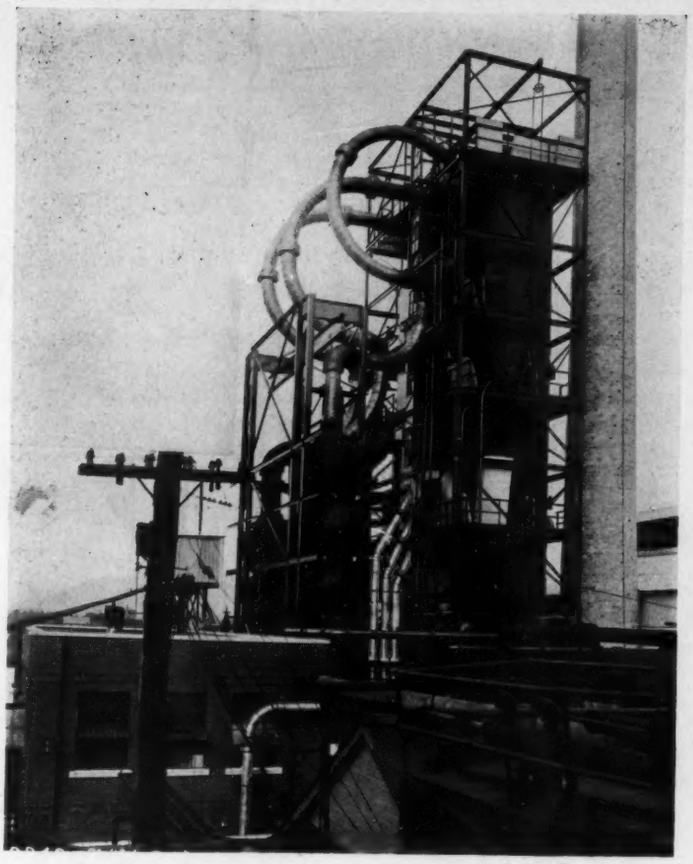
In cold settling an oil there necessarily must be convection currents in the tanks; whether the oil goes up the center and down the outside or down the center and up the outside. Or in other words we know there must be such currents because there is a difference of temperature present in the tank. We know of one refiner who used to start his brine through the coils then get on top of the tank and test the currents set up with little scraps of paper, and, we understand that when the currents so started pleased him he let the chilling continue. If they did not please him as they first started off, he would shut off the brine and let the tank quiet down for several hours. Others have held the theory that there is such a thing as "shock chilling" and that brine lines in that case became covered thoroughly with petrolatum and hence were insulated from the oil, and that, in such a case the settling was badly delayed. We held to this theory for awhile as we had several settlers hang on us for days and even thought of trying the old expedient of throwing a dash of aqua ammonia in the top of the settler which somebody said would work. We assumed that these settlers had been "shock chilled." We later decided that what caused those particular settlers to hang was the fact that they were not thoroughly mixed to start with. It is interesing to note that since we have used the Mason regulated pumps, the mixing chamber and the heat exchanger, there has been no example of a "hung" settler.

Weather Record

For something over a year the speaker has been keeping records of barometer, outside temperature, kind of weather, relative humidity and other date in relation to every settler handled at the Viking Oil Corporation plant. At first records were kept at 8 a. m., 12 m., and 5 p. m.—later every six hours day and night. We have some charts here which are not dressed up at all, but are simply the record as we keep them from day to day in our desk with this information contained thereon. We have reached a few conclusions and in order to start the discussion which we hope will follow, we will advance some positive statements, but we must say here that they are simply theories of ours. They are not definitely proven, but in our opinion the chances seem much in favor of their accuracy.

Per barrel of solution, assuming that we're chilling from approximately 95 degrees down to 10 degrees, gravities of solution compared to chilling time out of 160 settlers check up as follows: From 43 to 43.9 gravity 37.9 hours per thousand barrels; 44 to 44.9 gravity 36.3 hours per thousand barrels; 45 gravity upward 38.2 hours per thousand barrels.

The following data is given for what it is worth on settling time. In relation to gravity it must be stated however that these figures are subject to the application of some judgment because there are two or three cases in these figures where a proper mix was probably not made and that of course in the two lower gravity brackets. From 43 to 43.9 gravity, 44.1 hours; from 44 to 44.9 gravity, 41.2 hours; from 45 gravity up, 35.1 hours. This might lead us to think that the lighter gravity oils settle out quickest to a very large degree. We think they do settle out a little quicker, but on the other hand, the percentage



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of top mix received is so much smaller when the settler is light in gravity that it does not pay.

Color of solution has no apparent effect on time of settling or chilling.

RELATIVE HUMIDITY: Out of 143 settlers seven settled out when relative humidity was apparently going up. 136 settled out after one drop in humidity. 14 of these 136 might be considered as having settled out when humidity stayed stationary.

BAROMETER: Out of 144 settlers, settling took place when barometer was going up 94 times and down 50 times.

Barometer up, humidity down, 90 settlers out of 143.

Barometer up, humidity up, 3 out of 143.

Barometer down, humidity down, 46 out of 143.

Barometer down, humidity up, 4 out of 143.

Barometer conditions as such have no effect on a settling tank. Outside weather conditions in themselves have no effect on the settling of the oil, with one exception to be mentioned in a moment. Outside temperature has no effect on the settling of an oil in a settling tank after the chilling has taken place. That a solution of 43 gravity in a settler will settle out better than one of 46 gravity or higher, all other conditions being equal and regard being had to percentage of top mix received. The introduction of bright stock washings into a settler solution to be chilled down apparently has no effect on the settling. A sudden drop over five points in relative humidity seems to make a settler drop out in some six to 18 hours thereafter. This brings up the question of "why not make your own humidity inside of a settling tank," a problem on which we are now at work.

Keeping Up Production

By MacLEAN HOUSTON
United Refining Company.

ALL of us at times either overlook or forget to order extra drive chain for the wax oil chiller or something else just as important. We may overlook the need of a new part, or we may realize the need and neglect the order.

It will be the object of this paper to bring out the cost of such negligence, if possible, in order to impress upon the operators and managers of our plants the importance of keeping all equipment working at its utmost capacity.

To arrive at a basis for future calculations, let us first consider the plant that shuts down completely every Sunday. We will assume that it is a complete Pennsylvania refinery running 1000 barrels of crude per working day; that it has net profits of 50 cents per barrel of crude run and an operating and overhead expense (including all costs except that of crude oil) of 80 cents per barrel of crude run.

If it shuts down on Sunday, there would first be the straight loss in profits of $500.00 per week or $26,000.00 per year. This loss is bad enough, but it has been explained to me by the claim that the crude can be run some other year and the profit made at that time.

Cost of Closing Down

But what about the loss from expenses? We have paid out cash for these and will never get it back. The expenses of a plant shut down for one day at a time will be at the very least 50 per cent of the expenses of the plant operating not including the cost of crude oil. Based on this percentage and the assumptions above the expenses per day would be $370.00 for Sunday and $740.00 for week days. The Sunday expenses are a dead loss amounting to $370.00 per week or $19,240.00 per year.

From this we must reach the conclusion that a complete shutdown for each of the 52 Sundays in the year will be $26,000.00 plus $19,240.00 or a total of $45,240.00 per year.

Basing our problem on this example, each of us can insert the figures that apply to his own plant and figure the cost of a complete or partial shutdown. Or if it is a case of a still being shut down we can divide the total expenses (not including crude) plus the total profit for a month by the number of still days (number of stills times 30) that the plant has available. If you will do this with your plant figures you will realize to what extent you should spend money to keep your stills in operation every day.

Someone in the plant should make it his special business to study each shutdown, with the idea in view of avoiding a repetition in the future. When you go through the other fellow's plant ask about the problem that is worrying you. Nine times out of ten he would rather talk about shutdowns and how to avoid them than he would about how he makes his particular grade of oil.

Delays That Are Costly

Now let's consider a few definite examples that one actually sees through the Pennsylvania refineries. A few plants let a still cool for 24 hours before they send men in to clean it. Other plants use air jets or blowers and have the men in the still within three hours after it is pumped out. How many of us have not seen a filter house at a standstill waiting for the steam pressure to come up? I know of an actual case where a certain plant offered a man a position because he was able to show them how to start up their wax house. It was shut down on account of the failure of only one run of a chilling machine.

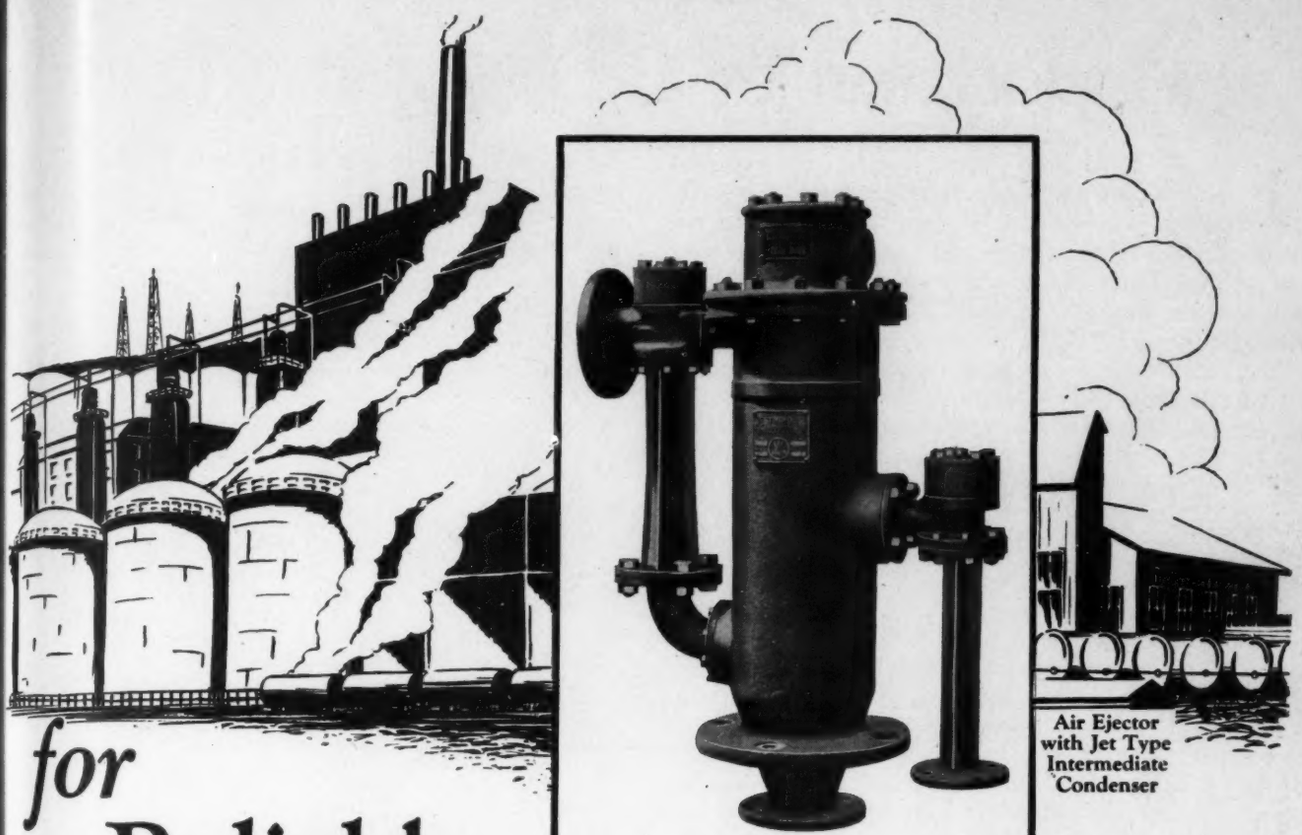
The only excuse is poor management, but very few men can say that their earth burners were not loafing one day and are behind in their work the next. We all know that the roofs of lubricating oil tanks spring leaks just at the wrong time, when they are full of finished oil. We have all had the railroad inspectors condemn a tank car for repairs after it has been loaded. We did not order the new earth for the filter house in time. A fire is caused by carelessness, defective equipment or poor design.

Any of us could, for another hour or so, go on mentioning these things which cause a loss in production. They all cost money and more money than most of us realize.

Then there is another type of trouble that also causes a serious loss of production and money. That is, that the finished oil does not meet the buyers' specifications. If it is found to be off test before it leaves the plant it invariably causes a loss in production. It is more costly to rerun oil that should be finished through the stills than it is to let the still stand idle, and sometimes it is far more costly to try to bring oil to test by running some of higher specifications and mixing than it is to rerun.

If it is found to be off test when received by the buyer, it usually causes an adjustment in the selling price and always a dissatisfied customer which is worse. The only thing worse than losing production in our plants is losing an outlet for the goods we produce.

In short—profits can be materially increased by the intelligent use of equipment.



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Exposition to Be Larger Affair

TULSA, Oklahoma.—With greater space reserved by equipment manufacturers and additional facilities provided for visitors, the fifth International Petroleum Exposition and Congress is ready for the petroleum industry. It will be opened October 20 and will continue through October 29. The grounds used in 1927, southeast of Tulsa, will be utilized again.

The amount of space reserved amounts to 35 per cent. above the amount in use in 1927. Facilities, aside from requirements for taking care of this addition to exhibitors, consists chiefly of provisions for the comfort and convenience of both exhibitors and visitors. The exposition plant is ready to take care of 200,000 visitors. An attendance of 50,000 can be cared for during one day.

Equipment for the refining and the natural gasoline phases of the petroleum industry will make up a big share of the whole exposition and will be responsible for much of the increase in space reserved by manufacturers. From the smallest of precision instruments to complete natural gasoline plants, these two divisions of the oil industry will be available for inspection. One complete absorption plant will be in operation.

The exposition grounds have been converted into an all weather plant through the building of additional concrete side walks and ample chat paving. The administration building has been enlarged and in addition to headquarters for the management will house branches of the telegraph and telephone companies, and the Tulsa post office. There will be facilities for information and the registration of those in attendance. Tickets will be held there for validation, to assure visitors of the special rates on all railroads.

The exposition management will maintain three offices in the city, one at the Mayo hotel, one at the Tulsa hotel and at the downtown office of the exposition. At either of these, visitors may register, giving names and home addresses. This service is being provided to permit visitors to keep in touch with their business connections while attending the exposition.

First Aid Meet

A convenience for the coming exposition will be parking space for those who come by automobiles. Adjoining the grounds, 160 acres of land have been leased. This will be under the care of a competent traffic corps. There will be no charge for parking. Another parking space has been provided for exhibitors. This has been paved.

A feature of the exposition of direct concern to the refining and natural gasoline industries is safety. The annual first aid meet of the Safety Section of the Mid-Continent Oil & Gas Association will be the most pretentious yet attempted. The National Safety Council is cooperating in this meet, as well as the United States Bureau of Mines.

The meet will be held the afternoon of October 22. Teams from the whole oil industry will compete for the prizes. That evening there will be a safety banquet at the Mayo hotel. Awards will be made then. In the past medals have been presented as part of the safety meet. The banquet will be attended by members of the competing teams, as well as executives of the oil companies. Speakers of note in safety work will be heard at the banquet.

The Safety Section of the Mid-Continent Oil & Gas Association will have a booth in the technical building.

Due to the exposition, the 12 standing committees of the Natural Gasoline Association of America will meet during the 10 days. These meetings will be held different days.

The Natural Gasoline Supply Men's Association will take advantage of the exposition for a meeting. This will be held in the Mayo hotel, October 24. A program is being arranged for this meeting. This association also will have a booth at the exposition and will have members present to reveal the purpose of the organization to all manufacturers of equipment used in the natural gasoline industry.

Golf Tournament

The annual exposition golf tournament will be run off, beginning October 22, when qualifying rounds will be played. Match play will begin the next day. All matches will be played over the Tulsa Country Club course. The tournament will be under the supervision of two special committees. J. A. Mitchell, chairman of the tournament committee of the country club, and Frank S. Gray, chairman of the exposition golf committee, will have charge of all arrangements. All golf players in any way connected with the oil industry are eligible.

As in past years, the 1928 exposition is drawing representatives from foreign countries. These visitors will be entertained in various ways. There will be a banquet in their honor, sponsored by the Tulsa Rotary club. Harry H. Rogers, former president of Rotary International, will preside at this affair.

A part of the exposition demanding widespread interest in advance of the opening is the process of selecting the "Grand Old Man" of the petroleum industry. Men from the whole oil country are entering this contest. To the man having the longest period of active connection with the oil industry to his credit, a medal will be presented. Entries have come from the many oil producing and refining sections.

The Mid-Continent Oil & Gas Association will hold its annual meeting during the exposition. Other organizations to meet during the period are the Mid-Continent section of the American Institute of Mining and Metallurgical Engineers and the Association of State Petroleum Geologists.

Many concerns, with headquarters in Tulsa will take advantage of the exposition to hold meetings of employes. This will have direct bearing on the refining and natural gasoline departments, since workmen in these plants will have the benefit of the exposition as well as contact with fellow employes from other sections of the country.

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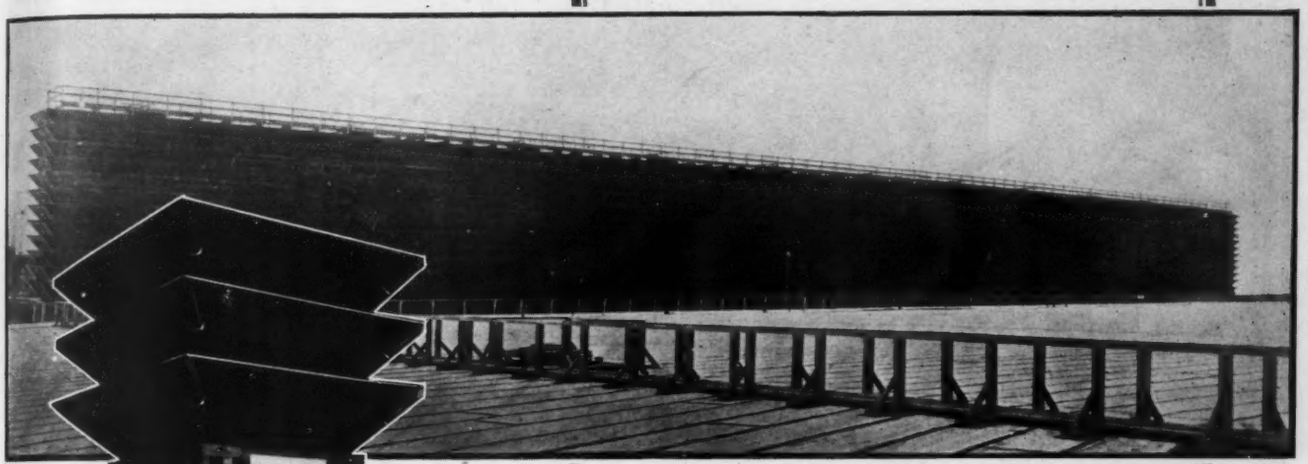

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Key to Plate 1

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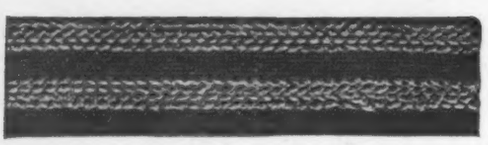
INTERNATIONAL PETROLEUM EXPOSITION, TULSA

Key to Plate 2

26—Alf. G. Heggem, vice president, Oil Well Improvements Company. 27—J. Burr Gibbons. 28—Frank Hinderliter, vice president, Hinderliter Tool Company. 29—Jacob France, Mid-Continent Petroleum Corporation. 30—R. A. Griffith, Sinclair Oil & Gas Company. 31—Ernest Nicklos, The Texas Company. 32—Harry H. Roger, Exchange National Bank. 33—Clyde Alexander, Phillips Petroleum Company. 34—W. M. Bovaird, Bovaird Supply Company. 35—Brooks Gutelius, Continental Supply Company. 36—J. H. Satterwhite, Natural Gasoline Supply Men's Association. 37—Robert F. Garland, oil producer. 38—D. F. McMahon, oil producer. 39—J. M. Hayner, Hayner Royalty Company. 40—Warren C. Platt, National Petroleum News. 41—W. A. Schlueter, Refinery Supply Company. 42—J. S. Sidwell, Prairie Oil & Gas Company. 43—Ray L. Dudley, The Petroleum Marketer. 44—Joe McGraw, McGraw Oil Company. 45—Ralph Pringle, Independent Oil & Gas Company. 46—C. P. Dimit, Gypsy Oil Company. 47—O. T. Dawson, National Supply Company. 48—Henry Greis, Westcott & Greis. 49—J. H. Brooks, Republic Supply Company. 50—George A. Dye, H. F. Wilcox Oil & Gas Company.

New Hydraulic Packing



Illustrated above is a new Crandall product. It is a hydraulic packing for use in plungers, elevators, or any kind of hydraulic work. It is made up of alternate layers of coarse duck and fine sheeting. It is extremely resilient and has a better "take-up" than ordinary packing.

This new packing can be surfaced with Luball, the new lubricant, that gives added life.

Furnished in rings, coil, or spiral.

Write any of our branches for a sample, or mail your request directly to me.

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Perfected Packings for Every Purpose

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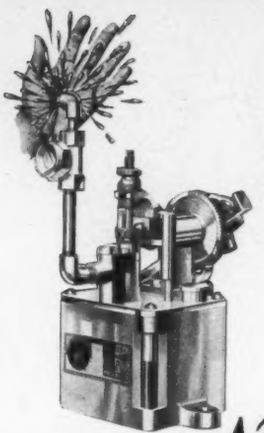
FORCE FEED

Lubricators



Against All Resistance!

HILLS-McCANNA LUBRICATORS ASSURE A POSITIVE, CONTINUOUS SUPPLY OF OIL—AUTOMATICALLY.

One drop of oil applied spasmodically won't do the lubricating—

It's the continuous application of oil in proper quantities that wipes out friction, guards your investment in equipment and minimizes the dangers of break-downs.

A Hills-McCanna Force-Feed Lubricator sends oil to all points of friction POSITIVELY. The "blinker" shows at all times whether or not the oil is flowing through the pipes *after* it leaves the pumping unit. This is your visible guarantee that no matter how far the oil pressure against the pumping might be and no matter how far the oil must be pumped through small pipes, it *is* arriving at its destination with a regularity that resists all temperatures and difficulties in the line. The oil "gets there"—and that is the most important feature of a Hills-McCanna Lubricator!

Hills-McCanna Lubricators are constructed upon the single plunger principle. This makes the oil delivery positive. No oil by-passes, nor is it ever under atmospheric pressure. Packed stuffing box assures high pressures. Types from 1 to 60 feeds of varying oil reservoir capacities and drives to suit all requirements.

HILLS-McCANNA CO.

2349-59 NELSON ST.~ *Chicago*

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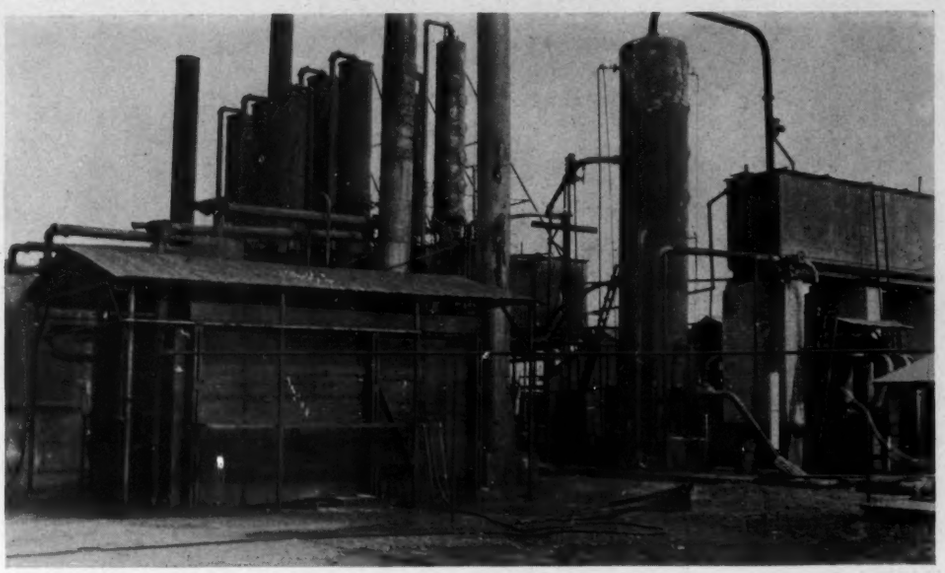
FORCE-FEED LUBRICATORS • PROPORTIONING PUMPS • SPEED REDUCERS



Three-inch Badger tube still and tower at Lubrite Refining Company's East St. Louis plant.

Modern Equipment Keeps Lubrite Plant Abreast of the Times

By GEORGE REID
Associate Editor

THE program of modernization at the East St. Louis plant of the Lubrite Refining Company, which began six years ago when the original installation was converted from a lubricating oil plant running South Texas crudes, to a gasoline producing refinery, has been continuous, and company engineers have kept the installation abreast of the times through the application of modern equipment to the job at hand.

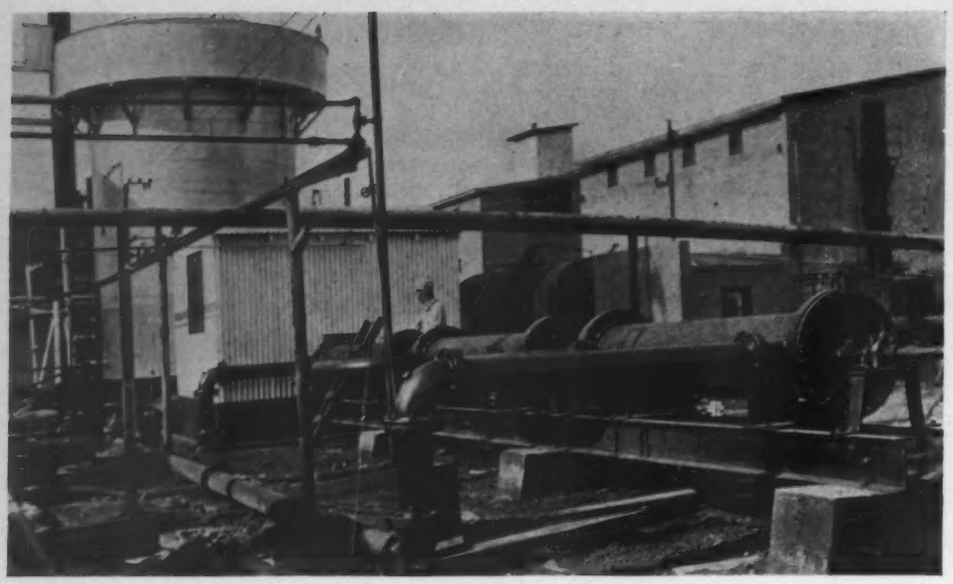
The original plant has been converted from batch operation of still with air cooled fractionating columns to a continuous battery equipped with bubble type columns of the Badger type, designed especially for the fractionation of close fractions from Mid-Continent crude. This oil is delivered by pipe line direct from the Oklahoma fields. Four of the shell stills are equipped with bubble towers. The fifth still is now being provided with a Winkler & Koch bubble type column.

In addition to this improvement in efficiency and capacity of the shell still battery the company is operating a 1200-barrel three-inch Badger tubular retort, which is also equipped with a combination vaporizer and bubble tower of the same make. Crude oil stripped of its lighter components in the skimming plant is taken directly from the last shell still and handled through a large simplex National Transit hot oil pump at a temperature of around 640 degrees and discharged into the pipe still.

The pipe still breaks this residuum into a light overhead distillate and gas oil, and produces a fuel oil of 16 gravity with a high heating value. Both the gas oil and the fuel oil are marketed as produced by the tube still operation. Such distillates are in brisk demand in the St. Louis area due to the development of a large local business in furnace oil for both domestic and commercial consumption. Products of the skimming plant consist of gasoline, kerosene and gas oil. the straight-run gas oil is utilized as charging stock for the company's cracking equipment, yielding a gasoline high in anti-knock values, which the company markets along with its straight-run product through its service stations.

Effect Heat Exchange

Crude or residuum leaving the last still in the continuous series is not cooled by exchange but is charged to the pipe still and heated to 800 to 850 degrees. An interesting problem in heat exchange has been solved in this connection. When the pipe still is not in operation, incoming crude is preheated by exchange with outgoing residuum in latest types of Ross and Braun exchangers. It was desirable to secure a preheat temperature of around 300 degrees on the incoming crude by exchange with hot residuum for the reason that a stream of light gasoline is removed and fractionated before the oil enters No. 1 still. Through the installation of three Braun and two Ross heaters or exchangers, the desired temperature was secured by exchange with the residuum



Sectional mixing or treating device, through which oil and chemical are circulated from the agitator, as described.

which amounted to approximately 40 per cent. of the crude charge.

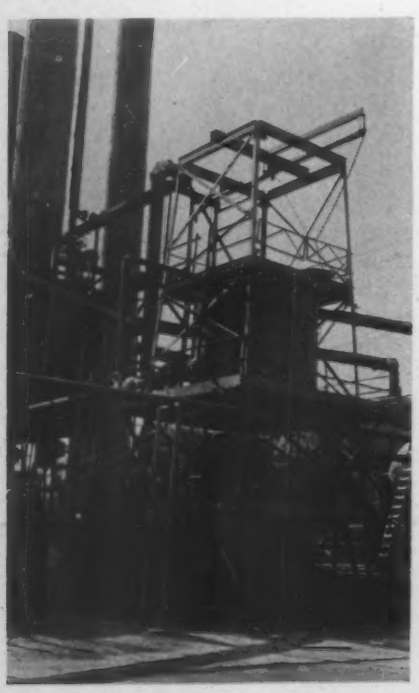
When the pipe still is operating the percentage of residuum is reduced to about 16 per cent., but instead of a temperature of about 640 F. its temperature is from 750 to 800 degrees. This residuum exchanges or preheats incoming crude oil in the two Ross heaters. The gas oil produced in the pipe still operation is taken from the middle of the bubble tower hot and conducted to the three Braun exchangers, where it, too, gives up heat to the incoming cool crude. This double exchange provides a preheat of the crude charged to 300 degrees. Careful design and calculations have provided the desired constant temperature to the incoming crude oil, regardless of which manner the refinery may be operating.

At the combined bubble tower and separator working in conjunction with the pipe still, temperatures are controlled in the top of the tower by means of recycling cool distillate of type produced by the still operations which is controlled in volume by means of an automatic temperature controller. All of the bubble towers in service at the plant are subject to automatic control of temperature, and in each instance the recycle material consists of the product yielded by the given tower. Hot oil pumps, such as those transferring hot residuum from the shell still battery to the pipe still, and those discharging the finished residuum from separator, exchangers and to storage, are housed in a metal building on concrete floors 10 or 12 feet below ground level. This assures constant suction to the pumps.

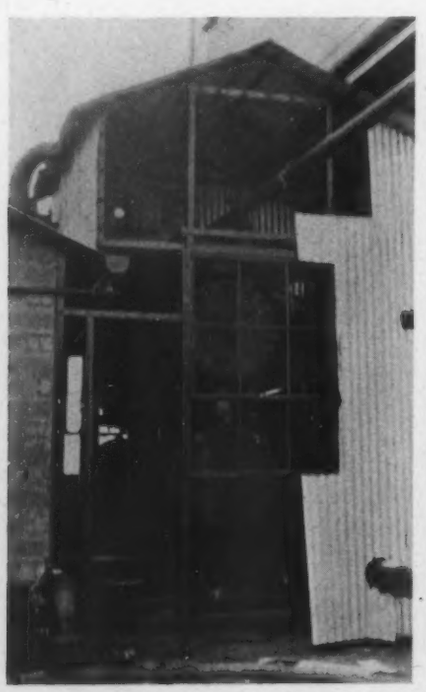
This still battery, originally designed to handle 15,000 barrels of lubricating oil crude per month, has been remodeled, rebuilt and provided with latest type of fractionating equipment to the end that the present daily through-put of 3500 barrels is handled with enviable ease and efficiency.

Vapor Phase Treating

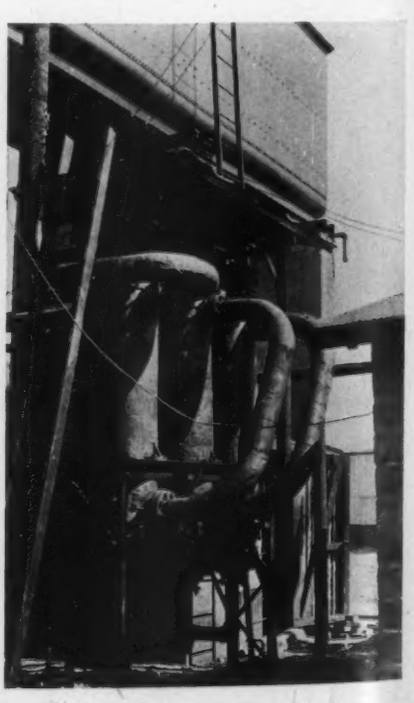
The second installation of the Gray vapor phase treat-



This is the second Gray vapor phase treating tower installed. View shows the details of the devices perfected for speeding up charging the tower with fresh fullers earth.



After partial preheat from gas oil exchangers the crude passes through these Ross heaters, exchanging with heavy residuum from the bottom of the tower, preheating the crude charged to 300 degrees.



Heat exchangers of Braun type preheating crude charged to continuous battery by exchange with gas oil from the bubble tower.

Perfect Control!

Many millions of gallons of oil find their way from the oil fields of the west to the great refineries of the east through pipe lines controlled by Darling Gate Valves.

The experts in charge of both production and distribution know Darling Gate Valves can always be depended upon to open easily and close tight—all anyone expects of a valve, but it takes a Darling to satisfy those who demand simplicity, long wearing quality and ease of operation.

Catalogue No. 15 tells how and why. Write for it.

DARLING VALVE & MANUFACTURING CO.
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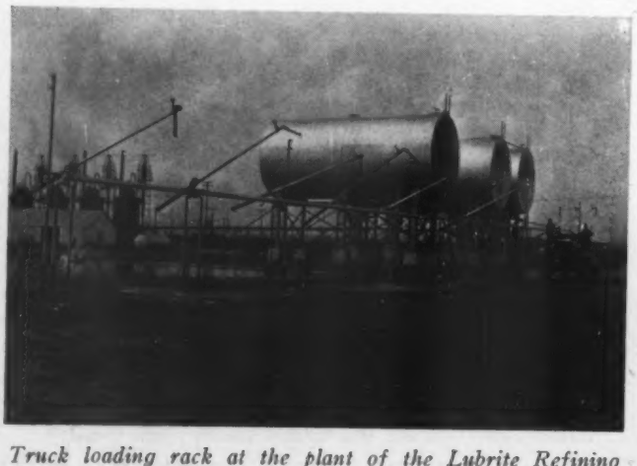
ing tower was placed in service at the Lubrite plant. The installation of this tower effected the substitution of fullers earth for acid and soda. The Gray tower has been in service for a number of years in connection with a rerun still handling cracked or pressure distillate semi-continuously.

A device for loading the fresh earth into the tower has been perfected by the men at the plant which has greatly reduced the time required for recharging this tower. Above the working platform at the top of the tower a steel framework supports a short track extending outward over the edge of the platform. On this track a pulley and shives are installed. In operation, the truck loaded with bags of fullers earth drives to the base of the tower supports and fastens hooks to the bag of earth. Driving to a predetermined spot the bag is hoisted to the top platform. At this time a workman pulls a rope and the shives carry the bag back into the platform and directly over the loading aperature in the top of the tower. Here a workman slashes the threads at the top of the bag with a knife and the earth dumps rapidly into the tower. So rapidly is the work of hoisting and emptying the bags that the usual four tons of earth is placed in the tower in 40 minutes in this manner.

Gasoline Recovery

In an effort to reduce plant losses, slightly increase the recovery of gasoline and to reduce the operating hazard, the company installed the first compression unit of gasoline recovery plant four years ago. The first unit being highly efficient, was quickly followed by the second unit and all crude oil tanks, gasoline tanks, and receiving houses were tied into the gas collecting system. The present installation consists of two Ingersol-Rand direct connected steam-driven compressors and the usual cooling coils, accumulator tanks, etc. When the entire refinery and cracking equipment is in operation, this recovery plant has produced as much as 40,000 gallons of gasoline per month and supplied sufficient fuel gas for the operation of two or three boilers at the power house.

The Lubrite plant is fortunate in the matter of water supply since wells on the plant yard drilled only 100 feet provide sufficient cool water for all uses. Water from one of these wells at the rate of 450 gallons per minute has a constant temperature of 59 degrees. That portion of the water employed for cooling purposes is carried from the condensers through an overhead flume and concrete ditch system to the water pit. Water for boiler consumption however, must be treated through a Page & Jones water treater, using soda and lime, where the hardness is reduced from 39 to 4 grains.



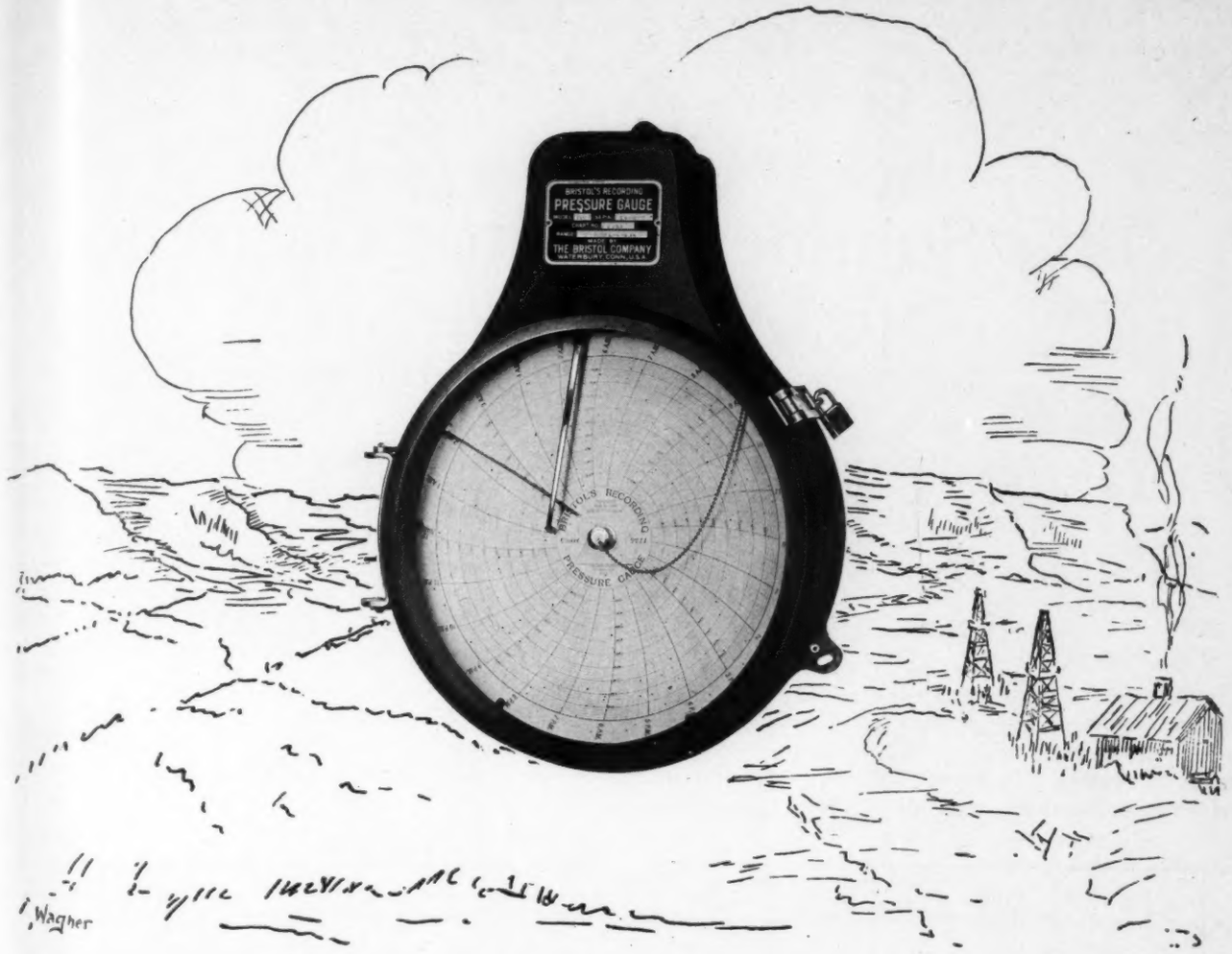
Truck loading rack at the plant of the Lubrite Refining Company, St. Louis. Note counter-balanced loading spouts with double swing joints.

Treating Losses Reduced

With the Gray vapor phase treating tower in operation it is not necessary to acid-treat any of the refinery products. Three large batch agitators are employed in doctor treating and caustic washing the various distillates produced. Through the installation of a sectional mixing device the procedure of blowing with air to secure intimate contact between gasoline and chemical was eliminated. The mixing chamber is really three mixing chambers eight feet in length and 20 inches in diameter. A central shaft extends through all three chambers which is provided with alternately pitched paddles, and this shaft can be rotated speedily by a small steam engine. Gasoline and chemical flow through the three separate mixing chambers by means of six-inch transfer lines. The charged agitator is circulated through the mixing device and usually the batch is treated to specifications at the end of one complete circulation. The usual treatment consists of doctor solution, unless a caustic wash for the removal of hydrogen sulphide is all that is necessary. Also, it has been found unnecessary to rotate the shaft by means of the steam engine for the desired results are secured by simply pumping the oil and chemical through the three mixing chambers. Using the semi-continuous system as described has effect a marked decrease in treating losses, cutting this loss over half, in fact. Further, the treater has found that he can use solutions of caustic somewhat weaker than formerly, thus effecting a saving in chemicals, and again, the time required for treating has been decidedly shortened with a corresponding decrease in labor charges at the treating plant.

Fast Truck Loading

At refineries such as this, where a large proportion of the products are distributed locally, the matter of loading of gasoline trucks assumes much importance, for the faster these trucks can be loaded the more trips they can make daily, and the number of trucks and drivers required can be limited. At the Lubrite refinery three 15,000-gallon tanks are used for supplying trucks. One of these tanks handles the company's premium motor fuel and two are given over to regular gasoline loading. A four-inch header or loading line extends laterally for sufficient distance to provide spotting space for six trucks. Double swing joints of the A. Y. McDonald type are provided at each of the eight loading spouts. Two of these spouts are used for the premium gasoline. The loading spouts are counterbalanced so that they can be readily thrown back out of the way, or more easily handled when the truck is loading. At the end of the spout another swing joint is provided and an 18-inch nipple attached. The load-



The New Model 11-M

[*Moisture-Proof*]

Bristol's Recording Pressure Gauge

This newly designed Recording Gauge incorporates many attractive features which should prove of interest to users of Bristol's Recording Instrument Equipment throughout the Refinery and Natural Gas Industries. Several of the more important items are:

1. Moisture-proof case construction—which permits use of this type of instrument at points where exposure to moisture is unavoidable, either in the plant or out-of-doors on exposed oil or gas pipe lines, etc.
2. Aluminum case—(not a zinc casting).
3. Has the Original Bristol's Form case construc ion, which is ideal for most efficient mounting of operating mechanism.
4. Inverted penarm is standard equipment.
5. Chart dial, pen-lifter and hub-cap are specially designed to facilitate easy removal of charts without smearing the ink record.
6. Easy access to clock for winding, regulating, stopping or starting by simply removing chart.
7. Clock parts are cadmium plated to resist action of moisture.

Characteristic "Bristol's" features of simplicity and ruggedness are perfected to a high degree in this new model. In fact, from the standpoint of service, accuracy, and all-round reliability, it leaves little to be desired.

The Bristol Company, Waterbury, Conn.

Branch Offices:

Boston	New York	Philadelphia	Birmingham	Pittsburgh
Detroit	Chicago	St. Louis	Denver	San Francisco

ing spouts are two-inch. With this equipment a three-compartment truck makes one stop and is spotted for loading all three compartments without moving. Speed is acquired in that one stop is sufficient for the truck to make, and the average time for loading a truck is six minutes. With two 1500-gallon and four 1000-gallon trucks at the rack at one time, all can be loaded full in 14 minutes by gravity flow through the four-inch loading line. Trucks which formerly averaged two trips daily are now averaging four trips out of the plant each day.

This Summer's Motor Gasoline Is More Volatile

THE motor gasoline marketed in the United States this summer is slightly more volatile than that sold a year ago, according to the United States Bureau of Mines, Department of Commerce, which recently completed its 18th semi-annual motor gasoline survey. The increase in volatility is shown by a lowering of the distillation temperatures, ranging from 2 degrees F. at the average initial boiling point to 4 degrees F. at the average end point.

In the past there has usually been a distinct difference between "summer" and "winter" gasoline, that marketed during the summer being less volatile than that sold during the winter. During several years this difference was very small and was confined to the lower end of the distillation range. This summer the average figures indicate a decided return to the sale of a less volatile summer-grade gasoline, the change being especially evident in the samples from New York, Washington, Chicago, New Orleans, and St. Louis. This difference is most noticeable in the initial and 20 per cent. points. A study of the individual analyses, however, shows a general tendency toward the marketing of a standardized product, as individual variations from the average are small.

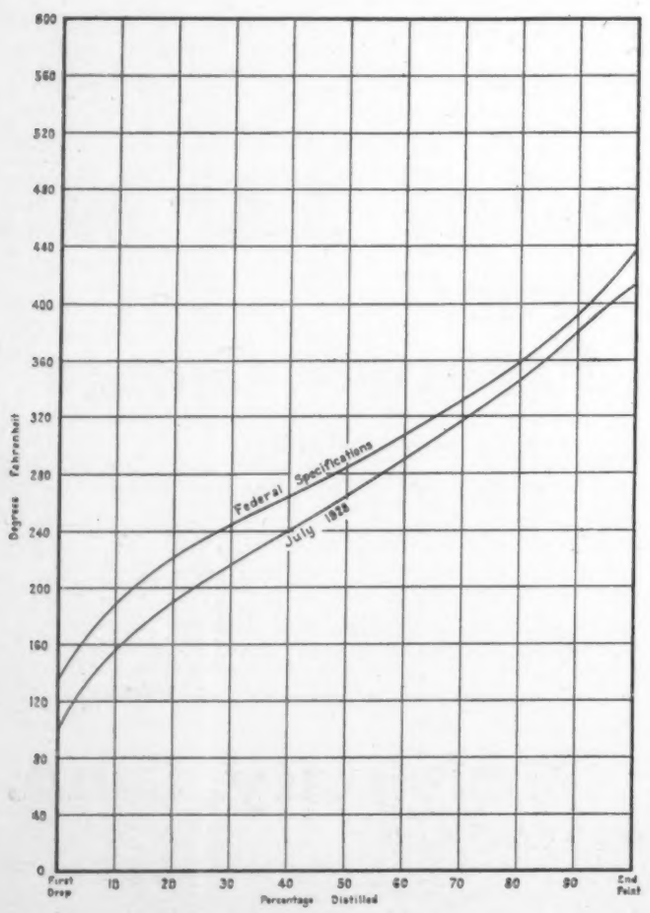


FIGURE 1
DISTILLATION CURVE OF AVERAGE GASOLINE

Although the gasoline marketed this summer is more volatile than that sold during the summer of 1927, it is less volatile than that marketed in January, 1928. There is a decided tendency toward better fractionation in the manufacture of gasoline.

During the past nine years the Bureau of Mines has made semi-annual surveys of the gasoline marketed in the United States. The cities in which samples were collected have been chosen as representative of the more important marketing territories, as it is obviously impracticable to obtain a sample of every gasoline sold in the entire country.

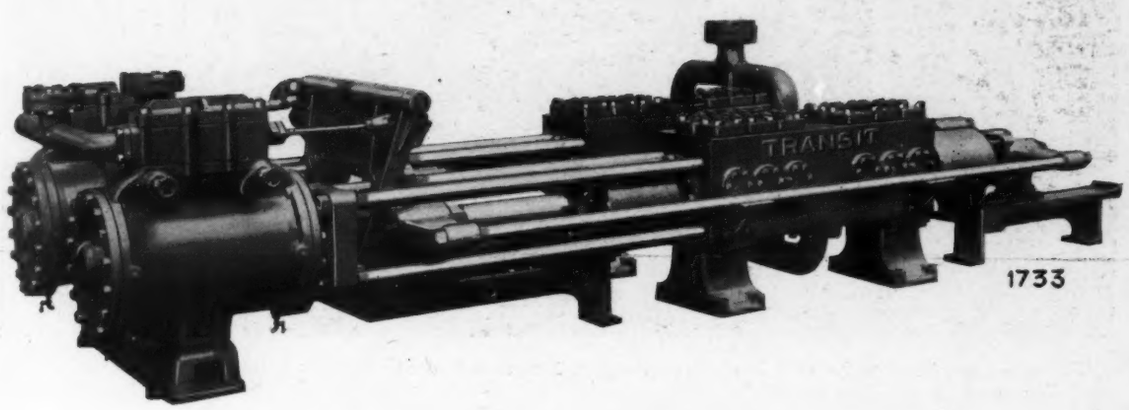
The cities in which the 18th semi-annual motor gasoline survey was conducted are Boston, New York, Washington, Pittsburgh, Chicago, New Orleans, St. Louis, Omaha, Denver, San Francisco, Bartlesville, Oklahoma, and Laramie, Wyoming. Detailed information in regard to the results of the survey are given in Serial 2887, by E. C. Lane, D. B. Taliaferro, Jr., and J. A. Mann, copies of which may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

The former Kling-Del refinery at Wainwright, Alberta, Canada, has been taken over by Wainwell Oils, Ltd., and it will soon be completed. A group associated with the Wainwell company is organizing a refining company to be called the Absher Refining Company, which will take over the casinghead plant of Gypsy Oils, Ltd., in the Wainwright field and also operate the Kling-Del refinery at Wainwright.

In return for a block of its stock, the Absher Refining Company will acquire from the Bituminous Sands Extraction Company the right to use the Absher process in the Wainwright field—a process invented by J. O. Absher, using steam to force oil from the tar sands.

TRANSIT PUMPS

For Hot Oil



TRANSIT 16 x 5 x 18" Duplex, forged steel fluid end Hot Oil Pump. Normal capacity 143 B.P.H., 1000 lbs. working pressure. Length 17', width 5' 7". Also made with compound steam end.

You know the furnishing of pumps for hot oil service is an engineering proposition, as practically every installation requires a different pump.

If you are contemplating the installation of hot oil pumps in the near future, why not let us make a proposal on your requirements now? We manufacture a complete line of hot oil pumps for any size refinery.

Right now, we have the engineering talent and manufacturing facilities available to give you the best of service.

Last Fall we worked day and night to keep up with the orders for TRANSIT Hot Oil PUMPS, but even then some good refiners had to content themselves with other makes of hot oil pumps.

Address the Home Office or any District Office of the Company

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FRICK-REID SUPPLY CORPORATION
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REPUBLIC SUPPLY COMPANY
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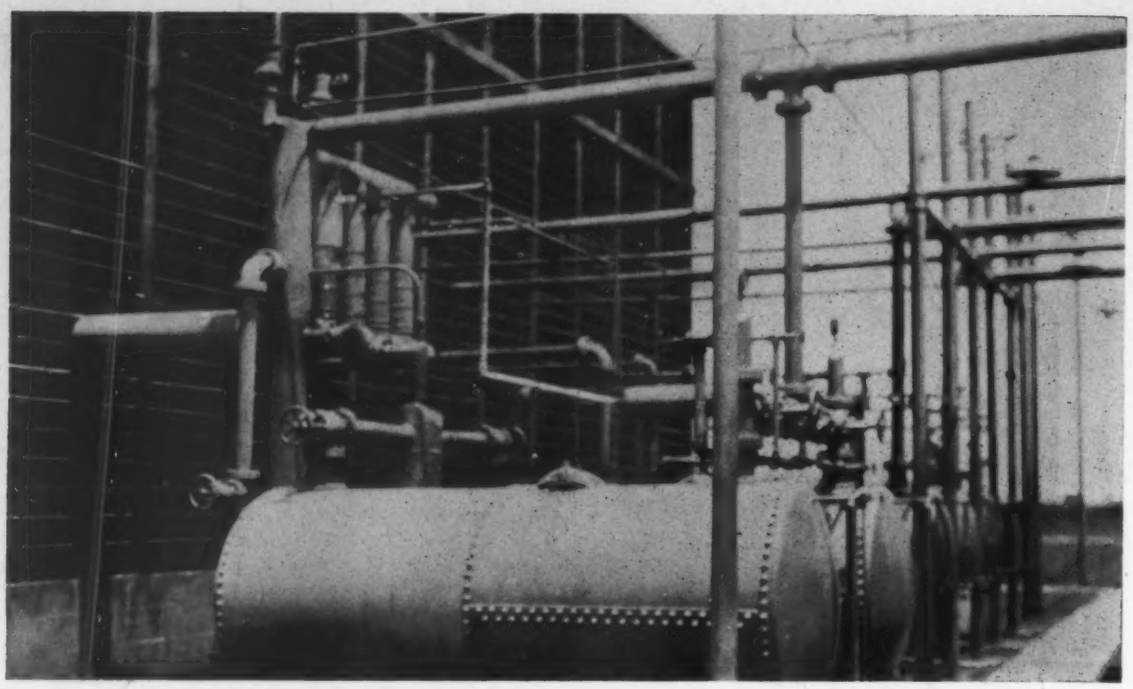


Type of accumulator tanks used in conjunction with the recompression tail gas recovery system at Col-Tex gasoline plant. Eight-inch headers at right of look-box header are expansion chambers for compressed gasoline as it blends with absorption product.

Stable Gasoline by Recompression of Tail Gasses

By GEORGE REID
Associate Editor

THE "tail gas" recovery plant installed in natural gasoline plants is rapidly becoming extensively employed by the industry as a means of effecting greater efficiency in gasoline extraction. The plant is analogous to the gasoline recovery plant as employed by the refining industry for the extraction of additional gasoline from light oil tank vapors and gases from the receiving house. Such plants are equally important in both branches of the industry.

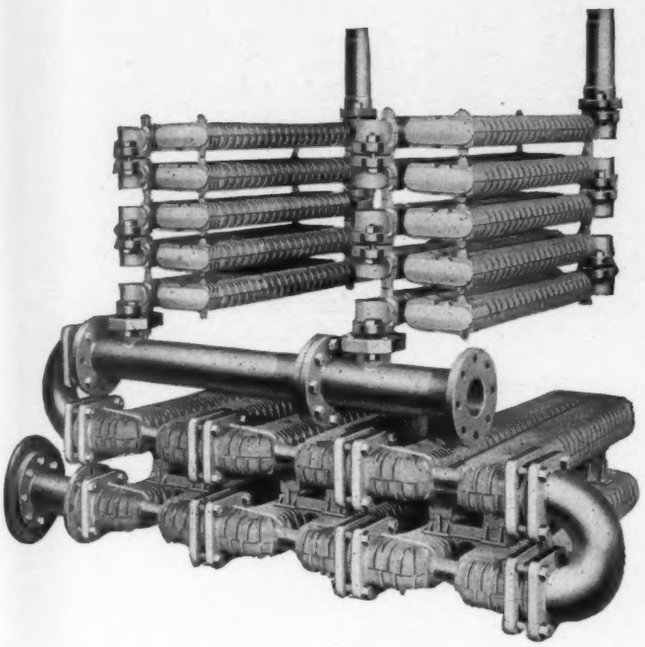
Former practice included passing the green gas from the field through the absorbers and the extraction of that portion of the gasoline content which was feasable or possible with towers of low efficiency. Upon distillation of the gasoline from the rich absorption oil the plant production consisted of only that portion of the gasoline which condensed in the coils, leaving the remaining tail gases to escape into the air, burned as fuel, or conducted away from the plant through the residue or dry gas lines.

With present highly efficient absorbers, which in some cases are connected in series for the re-absorption of the gasoline, the green or rich gas is denuded of its gasoline content to a point much below former practice. Operators now strive to get "all" of the gasoline out of the gas. This practice results in the absorption and handling of greater amounts of the wild or non-condensible vapors, but the industry has learned through its technicians that along with this wild and uncondensible gas there is an interestingly high percentage of very stable gasoline which was formerly lost through the lack of tail gas recovery plants. This has led to the extensive employment of recompression or re-absorption plants which work on nothing but the material derived from the distillation procedure, storage tanks and loading rack. In many instances the tail gas gasoline recovery equipment is responsible for 50 to 60 per cent of the plant's total gasoline production. Absorbers of much higher efficiency provide such plants with larger quatities of uncondensed gases and vapors to work on by concentrating all of the available or "absorbable" constituents of the gas into one fraction. The work of the tail gas plant then consists of eliminating the undesirable portion (gaseous and wild vapors) and returning the desirable stable gasoline to the storage tanks.

Recompression "Tail Gas" Plant

The Columbian Gasoline Corporation, operating a number of absorption gasoline plants in North Louisiana, and two in West Texas, employs the recompression method of tail gas gasoline recovery with very satisfactory results, producing a stable gasoline of low vapor pressure. The pressures employed at each of the plants varies to a certain extent, dependent upon the grade of gasoline being manufactured. In the November, 1927,

STERLING Oil Sections
and Accessories *are cast* Exclusively *of*



ARCO METAL

FURTHERMORE, your condenser can be ARCO METAL complete from above the water line to the box outlet.

In terms of performance this means—

1. Greater corrosion resistance
2. Greater strength
3. No leaks
4. Fewer repairs
5. Longer life
6. Lowest condensing cost

ARCO METAL is manufactured from special analysis ni-chrome alloy iron, and is cast by a process which insures a structure in the resultant product that not only possesses superior strength, but is also extremely resistant to the corrosive as well as the erosive action of acids and alkalis. This is due to the fact that in the method employed in producing ARCO METAL we obtain a very fine precipitation of graphite with a semi-pearlitic matrix interwoven with a dendritic structure, which characteristics are responsible for the superior physical qualities of ARCO METAL SECTIONS.

ARCO METAL PIPE is made of the same material and inasmuch as it carries standard pipe sizes, it can be threaded with standard pipe tools and made up with standard fittings. This makes an ideal pipe for final connections through the condenser box and for rundown lines and all troublesome pipe jobs in the refinery.

AMERICAN RADIATOR COMPANY

INDUSTRIAL DIVISION No.02710

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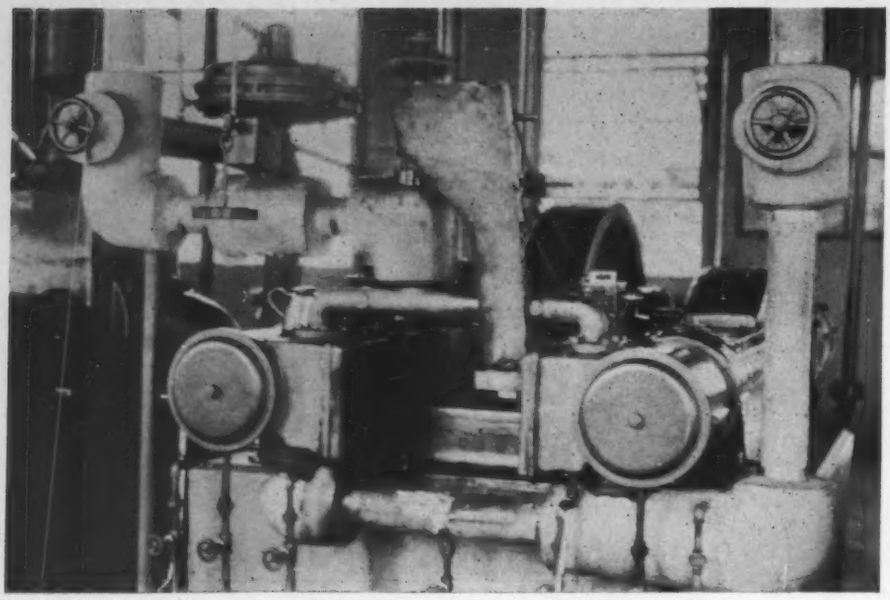


Close-up of one of the compressors used in recompression tail gas recovery plant, showing details of installation and regulators controlling operation.

issue of The Refiner and Natural Gasoline Manufacturer, page 50, the writer described in detail the processes and equipment employed by this company at its Fowler plant. Concerning the recompression system as employed at this plant the following was presented: "Up to this point the plant operation features are similar to the usual absorption plant practices, but the re-compression of uncondensed vapors after the condensation at atmospheric pressure is a little different from customary methods. The vapors which do not condense at atmospheric pressure are picked up by compressors and compressed on the low side to about 40 to 60 pounds, and passed through additional cooling coils. The gasoline thus produced is conducted to a specially designed accumulator tank, and expanded from its pressure to atmospheric pressure, blending with the first condensate derived from the distillation operation. The uncondensed vapors from this first compression operation are conducted away from the tank and into the high side of the machines where they are compressed to 200 to 250 pounds pressure, to be again released or expanded from its high pressure to atmospheric pressure to blend back with the gasoline produced by the two previous operations, that of atmospheric distillation and condensation at 40 pounds pressure. The accumulator tank employed is of company design, and the proper name for it should perhaps be stabilizer or rectifier, since the expansion of the two compression types of gasoline are caused to mix or blend with the gasoline derived from the still in such a manner that excellent stabilization is effected.

"The compression plant also produces gasoline from vapors derived from storage tanks, and from the loading rack where cars are loaded. The compressors are Ingersol-Rand type 10 machines operating at the pressures mentioned, but pulling but a very slight vacuum on the small tanks from which the vapors for compression are derived."

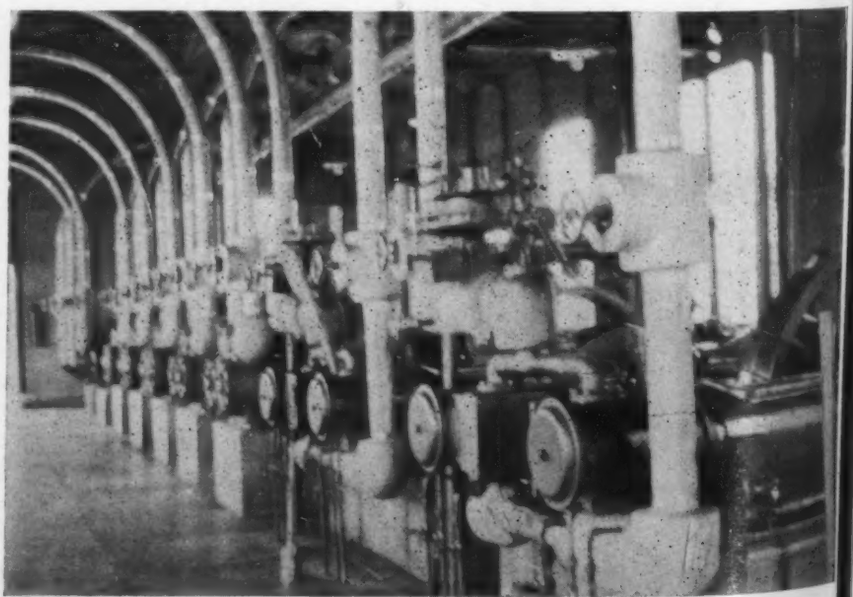
ColTex Recompression System

At the ColTex absorption gasoline plant at Fairbanks, operated by the Columbian organization, a well designed recompression tail gas recovery plant is operating. At this plant, Ingersol-Rand 10 by 14 and 7 by 14-inch compressors are used. An accompanying view of the compressor shows how the Chaplin Fulton gas regulator is installed and operates on the suction line to the low side of the machine. This machine pulls a very slight vacuum on the accumulator tank into which the three grades of gasoline are blended as the final product.

Plant terms designate the absorption gasoline distilled from the rich or fat oil as pre-cooler gasoline. The vapors and gases which are uncondensed subsequent to the distillation procedure and vapors from the gasoline storage tanks, are taken into the low side of the compressor from the pre-cooler accumulator tank and compressed to 40 pounds pressure. The compressed vapors are then discharged through cooling coils and to an accumulator drum specially designed for the operating pressure where it is accumulated as inter-cooler gasoline.

From the inter-cooler gasoline tank the remaining uncondensed gasoline vapors pass into the high side of the compressing machine which boosts them to a pressure of 250 pounds. After this second compression the vapors are discharged to a third cooling coil from where they pass into the after-cooler gasoline accumulator tank.

Through this method three grades of gasoline are accumulated in separate drums or tanks. By means of small lines extending almost to the bottom of the inter-



Interior of ColTex Gasoline Company's Fairbanks, Louisiana, compression or booster plant. The first two machines in the picture are used for recompression of the gases coming from the absorption processes.

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18% Chromium 8% Nickel

CRACKING STILL TUBES

Resist Oxidation in Continuous Service at Cracking Still Temperatures

ENDURO 18-8 is a permanently stable Austenetic metal *not* affected by variations of temperature which are detrimental to other materials.

Its superior oxidation resistance is indicated by the following test, run on similar size samples in an electric muffler furnace under an oxidizing atmosphere. Figures give the percent loss in weight in twelve hours.

Comparative Oxidation of Enduro 18-8 and Low Carbon Steel at elevated temperatures

	1600° Fahr.	1700° Fahr.
Steel	7.68%	9.75%
Enduro 18-8	.44%	.53%

Because of this high oxidation resistance of Enduro 18-8, and its great strength at high temperatures, still tubes of lighter gauge material can be used. No increment in the wall thickness for oxidation losses or safety is necessary. It is likewise highly resistant to all common corrosive agents in oil, and will not become brittle after continued service throughout the entire range of cracking still temperatures.

Still Tubes of Seamless Enduro 18-8 will substantially lower replacement costs, both for maintenance and material, where other materials fail from corrosion, oxidation or embrittlement.

The Babcock & Wilcox Tube Company will be glad to discuss your tube problems with you, and furnish further information relative to the advantages of Seamless Enduro 18-8.

Castings of Enduro 18-8, made in high frequency induction furnaces, are also manufactured by The Babcock & Wilcox Tube Co.

Enduro 18-8, a corrosion-resisting, heat-resisting alloy containing 18% Chromium and 8% Nickel is produced by Central Alloy Steel Corporation, and is fabricated into Seamless Tubing and Pipe exclusively by The Babcock & Wilcox Tube Co.

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cooler and the after-cooler tanks, the gasoline accumulated in each of these tanks is blown under the respective pressures of the tanks to a mixing or blending header just back of the look-box. The one-inch lines used for transferring the compression gasoline back to this header are equipped with small valves which are cracked open slightly, so as to control the liquid level of the gasoline in each drum.

When the liquid passes into the header, it expands rapidly into an eight-inch chamber and mixes with the absorption or pre-cooler gasoline. This expansion and rapid cooling causes condensation of the low pressure gasoline and the refractionation of the high pressure gasoline. Uncondensed vapors reaching this part of the system are taken from the top of the blending header and conducted back into the low side of the compressor, then through the high side, to be finally vented into the fuel line through a relief valve at the after-cooler tank which is operating at 250 pounds pressure. In this manner the wildest vapors are finally disposed of, and only the gasoline which is stable remains in the final blend after its recompression and expansion. Operating pressures vary from those given to pressures somewhat high, depending, of course, upon the grade of gasoline desired by the operators.

Palmer Corporation Recompression System

In the Refiner and Natural Gasoline Manufacturer, issue of January, 1928, on page 87, W. F. Fulton, chemical engineer for the Palmer Corporation, discussed the recompression "tail gas" recovery plant of the Palmer Corporation's Cotton Valley, Louisiana, plant in some detail. That part of Mr. Fulton's article which deals directly with the construction and operation of the plant, and the results secured through the use of the recompression system, is republished here because of the general interest in the question of increasing recovery of stable gasoline:

"* * * The vapors leaving the still are 240 degrees, and leaving the dephlegmator the vapor temperature is 210 degrees. The vapors are then passed to the low pressure coils which are kept at 25 pound pressure (this being the same pressure that is kept on the still—the vent tank is kept at 55 pounds pressure). The gasoline that is condensed in the low pressure coils is collected in a receiving tank and trapped to the storage tanks continuously. The vapors from the low pressure tank are passed to the low side of the compressor and are compressed to 60 pounds, then passing through more cooling coils. This gasoline is collected the same as the low pressure condensate and passed to storage. The vapors from this tank are passed to the high side of the compressor and compressed to 200 pounds. This liquid is then expanded back into the low tank, causing condensation of the low pressure gasoline and the refractionation of the high pressure gasoline, which passes through the system again and then is vented. All of the vapors from the storage tanks, which are kept at 15 pounds pressure, are vented into the compressor for rerunning.

"* * * In order that all of the gasoline is removed from the gas, the gas is rerun through two absorbers, bringing it in contact with fresh oil each time it passes through. In this way we remove all of the gasoline and some wild gases which are not condensable. Now in the process of distilling this gasoline from the oil we get a vapor that contains enough wild gases to raise the critical pressure of the vapors, making it harder to condense, but we at the same time make the fractionation of the light vapors easier because of the wild gases which tend to give us material for compression, and in the last stage of compression it gives us the benefit of a large quantity of high gravity product for expanding back into the low stage of the system. On the expansion of the light gasoline back into the low stage we cool the low stage gasoline and condense out more of the heavier fractions. At the same time we remove from the liquid expanded, the propane and other wild fractions, which are passed through the high pressure system again, and in this manner the propane is eventually worked out as vent gases.

Vent Gas Control

"In the control of the vent gases we find that the gases, which are sometimes classed as "wild vapors" and which will raise the vapor tension if condensed and put into gasoline, are not all wild but contain a large amount of commercial gasoline which is mixed with the wild vapors. To give an example of this: At one plant with a tail absorber, no compression system for condensation, the outlet of the tail absorber tested 3000 gallons per million. This plant was losing about 40 per cent. of the gasoline that it was possible for it to make, and loading loss and vapor tension of the gasoline made were very high, even though they did not use recompression methods.

"The gravity of the gasoline made by the compression of the vapors is always higher, due to the large amounts of light gasoline they contain. This is a benefit to the refiner as he is selling his product on gravity and the higher the gravity of the natural gasoline the less he has to blend to make his gravity up to that desired. This is another complaint of the operator against compression as they claim that the gravity is too high and that their loss will be too great. This is not true, as we have made gasoline that was 92 gravity, with a vapor tension of 13 pounds at 100 degrees, and 60 per cent. of this product was condensed at 250-300 pounds pressure, the recovery of this gasoline being 90 to 93 per cent. We make a special product that is 90 degrees Be. gravity with a vapor tension of four to five pounds. This shows that it is possible to make very stable gasoline by compression of the still gases which are considered "wild" even without the use of a stabilizer, which is not necessary for the production of stable gasoline. * * *"

Pittsburgh.—The Burrel-Mase Engineering Company of Pittsburgh has charge of the construction of two new plants near Waynesburg, Pennsylvania: a 2000-gallon absorption plant for the George H. Weinrott interests of Waynesburg; and a solvent recovery plant for the Raybestos Company of Bridgeport, Connecticut.

The Effect of Temperature On Absorption Efficiency

By A. J. L. HUTCHINSON

Engineering Research and Equipment Company.

Read before the September, 1928, Meeting of the California Gasoline Association.

IT has been the general opinion of most people in the natural gasoline industry that the temperature of the lean oil, provided it was below about 80 degrees, was as low a temperature as was necessary. There h been considerable published on this subject by men who have done a lot of experimental work on the old grid towers to show that below a temperature of 80 degrees no gain was realized, or a very slight gain at the most that did not justify the expense of obtaining lower temperatures. The advent of the multiple plate absorbers, however, where the oil and gas approach equilibrium very closely in the absorber, makes the factor of temperature a very important item.

In some plants large cooling surfaces are provided to bring the gas down to as low a temperature as possible while the oil cooling was very poor. The idea being that when the gasoline in the gas was cold it would be easier to "knock out." This is directly in opposition to theory and practice. As it is the vapor pressure of the gasoline when dissolved in the oil that governs absorption, the only effect a high gas temperature has is to raise the oil temperature.

Absorption Efficiency

The term absorption efficiency seems to have several meanings in general use. For the purpose of this discussion it is necessary to give it a very definite and limited meaning. Absorption efficiency is the per cent. of any constituent in the entering gas that is absorbed by the oil. By this definition the absorption efficiency of say butane and propane may be considerably different in the same absorber at the same time. This clearly definies the difference between plate efficiency and absorption efficiency. This difference in absorption efficiency is what is commonly called the selectivity of absorption.

From the work that has been done and published we are justified in assuming that Raoult's Law of Solubilities holds. By this law, absorption varies inversely as the vapor pressure and since vapor pressure varies directly as temperature, absorption must vary inversely as the temperature. This inverse ratio, however, is not a simple linear function.

By definition the absorption efficiency is not the same at any temperature for two different constituents. Therefore, we will consider one component of the system by itself. In an absorber the oil and gas approach equilibrium at the bottom of the absorber, it is the conditions that exist at this point that have a large bearing on the efficiency. If we assume that we have an absorber operating and extracting 60 per cent. of the butane with an oil circulation of 70 gallons a minute and the temperature of the oil at the bottom of the absorber 100 degrees, through some means, cool this oil down to a temperature of 80 degrees, we could cut our oil circulation to 51 gallons a minute and get the same extraction efficiency for butane or 60 degrees.

For Stable Gasoline

Under these conditions the absorption efficiency for propane will, however, not remain a constant but will decrease with the drop in temperature and lowering of the oil rate. With a circulation as above of 70 gallons of oil per minute in our absorber and a temperature of 100 degrees, the absorption efficiency for propane would be 18.3 per cent. while at a circulation of 51 gallons per minute and a temperature of 80 degrees F., it would be 12.9 per cent.

This brings up a point that is directly in contradiction to general practice. It is the general opinion that in order to make a more stable product in the plant the oil temperature and oil circulation should be raised. However, the reverse is true. Both the oil temperature and oil rate should be lowered, taking care the right ratio is maintained between temperature and rate. This point in the theory has been carefully checked in plant operations and found to be correct.

The vapor pressure of the constituents left in the oil from the still are higher the higher the oil temperature. As absorption is a vapor pressure phenomena and depends on the lowering of vapor pressure due to solution, the higher vapor pressure of the constituents in the lean oil at higher temperatures will retard absorption. This then is another important reason for cooling the oil to as low a temperature as possible.

In practically all plants an increase in oil circulation will raise the lean oil temperature to the absorbers. An increase in oil rate will usually lower the temperature rise through the absorber. Whether an actual gain in absorption efficiency for the useful constituents has been realized will depend entirely on the ratio of temperature increase to oil rate increase.

Los Angeles.—The daily throughput of the Eureka refinery, since the merger of the company with Italo Petroleum, has been increased from 2500 to 3000 barrels, and by about September 1 was due to be increased to around 4000 barrels.

Italo's new Trumble cracking process plant will be built adjoining the Eureka refinery, land for its location already having been purchased.

Increase in Fuel Economy Recorded at Refineries in 1927[1]

By G. R. HOPKINS[2]

A RECENTLY completed survey, made by the Bureau of Mines to determine the trend of fuel consumption at refineries in the United States, showed the following outstanding points: A decrease in the use of oil for fuel in 1927 of over 5,000,000 barrels as compared with 1926; a decrease in the use of coal of over 1,000,000 short tons; small increases in the use of both natural gas and refinery gas; an increase in the use of petroleum coke.

The decrease in fuel-oil consumption was approximately 2,000,000 barrels each in the Atlantic Coast, Texas, and Louisiana-Arkansas districts, with an increase of 1,000,000 barrels in the Indiana-Illinois district, or a net decrease of 5,000,000 barrels. The decrease in fuel-oil consumption by refineries in the Texas and Louisiana-Arkansas areas was offset largely by increased consumption of natural gas and refinery gas, whereas the increased consumption in the Indiana-Illinois region was more than offset by the decrease in coal consumption.

The use of coal for fuel declined from 6,052,000 short tons in 1926 to 5,031,000 short tons in 1927. Practically all of this decrease was recorded in the Appalachian and Indiana-Illinois districts, which at the same time showed the largest percentage increase in the use of oil for fuel. It is probable, therefore, that although coal prices also fell off, a considerable quantity of oil replaced coal in this area in 1927. In addition, the group of refineries, which are by location more or less definitely committed to the use of coal for fuel, undoubtedly succeeded in

[1]Printed by permission of the Director, U. S. Bureau of Mines.
[2]Associate petroleum economist, U. S. Bureau of Mines.

Natural Gasoline Association Adopts Motor Fuel Specification

AN account of its high volatility, natural gasoline has proven to be a very desirable component of present day motor fuels. The extent to which natural gasoline may be used in preparing blended motor fuels is limited solely by the vapor pressure of the fuel at the maximum operating temperature of the gasoline feed system of the automobile. If the vapor pressure of the motor fuel is too high for the temperature conditions under which it is used, vapor locking difficulties will be encountered. Several natural gasoline manufacturers have been marketing blended motor fuels containing very high percentages of the more stable grades of natural gasoline. This fuel has been most favorably received by the motoring public. It was, therefore, deemed advisable for the Natural Gasoline Association of America to officially adopt such grades and specifications for these blended fuels as would insure a first class motor fuel, having the desired properties of ease in starting, rapid acceleration, good mileage, freedom from crankcase dilution, and absence of the vapor locking difficulties.

The Technical Committee of the Association had available for its study of the problem of recommending specifications, the experiments of several manufacturers and marketers of these grades of fuels, data on the vapor pressures of motor fuels sold throughout the United States by the major companies for the past two years, the results of research work by Dr. G. G. Brown and the very excellent articles in the literature pertaining to the subject by other noted research men such as Wilson, Dickinson, Bridgemen, Cragoe, Hill and Geniessee.

The tentative grades and specifications adopted by the Natural Gasoline Association are presented below. Grade 90 is recommended for climatic conditions with an average temperature of 90° F. Grade 50 is recommended for climatic conditions with an average temperature of 50° F., while grade 10, a winter fuel, is recommended for climatic conditions where the atmospheric temperature approximates 10° F.

Tentative Specifications for Blended Natural Gasoline Motor Fuels Adopted by the N. G. A. A. Effective October 1, 1928

	Grade 90	Grade 50	Grade 10
Vapor Pressure at 90° F. not to exceed (lbs. per sq. in. absolute)	6.5	9.0	11.5
Initial boiling point not less than (° F.)	95	90	82
Temperature at 5% point (° F.); not over	120	120	120
Temperature at 50% point (° F.)	200-220	180-200	160-180
Temperature at 90% point (° F.)	380-410	360-410	340-410
End point (° F.)	425-450	425-450	425-450

Note: Vapor pressure by Reid method adopted by N. G. A. A., effective Sept. 1, 1928. Distillation test by A. S. T. M. method D 86-27 with following additional provisions: Test to be made at a room temperature not over 70° F. Losses on distillation to be added to the percentage recovery in determining intermediate boiling points. Distillation test results based on a barometric pressure of 14.4 pounds per sq. in. absolute.

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—produce gasoline without heavy ends of absorption oil.

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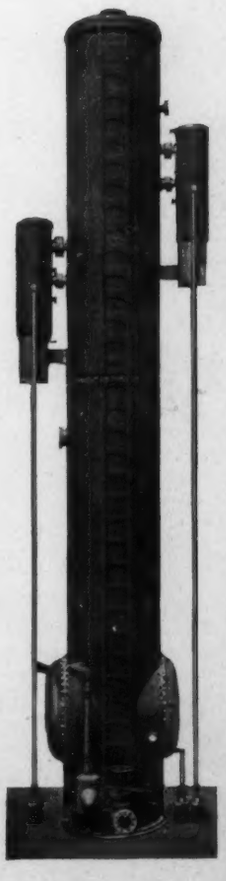
—partial pressure steam less than half that required by any other type distillation unit.



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saving a material amount of coal through the use of more efficient fueling methods.

A total of 130,815,000,000 cubic feet of natural gas was consumed for fuel at refineries in 1927. This represents an increase of eight per cent over the 1926 total. Nearly all of this increase resulted from the opening of a line from the Monroe field to Baton Rouge, La. Had this line not been opened, there would have been a decrease in the use of natural gas, as a number of districts, particularly the Rocky Mountain, reported decreases in its use. The use of refinery or still gases for fuel did not change materially during 1927, there being a total of 52,807,000,000 cubic feet burned as compared with 52,077,000,000 cubic feet in 1926. Refinery gases were largely a product of cracking and it was probably more than a coincidence that a few districts in which cracking slowed down in 1927 also reported less refinery gas used as fuel.

Refinery engineers have recently given much attention to the problem of devising a thoroughly satisfactory method of burning the increasing production of pressure-still coke. That some progress was made in 1927 would seem to be indicated by the fact that consumption at refineries increased from 408,000 short tons in 1926 to 450,000 short tons in 1927, the latter figure being equivalent to 40 per cent of the total output. Coke, particularly the type obtained by so-called dry distillation, makes a very superior fuel from point of heat units, but is one which requires constant mechanical supervision.

The problem of fuel economy continued to occupy the attention of many refinery engineers, and it was largely through their efforts that the fuel requirements in 1927 per barrel of crude refined were less than ever before. In order to arive at this conclusion, the consumption of the vaious fuels was reduced to their B. t. u. equivalents[3] and gave a total of 584,000,000,000,000 B. t. u. used in 1927 as compared with 630,000,000,000,000 B. t. u. in 1926. There were 779,264,000 and 828,380,000 barrels of crude petroleum refined in the United States in 1926 and 1927, respectively; these amounts on division indicated a requirement per barrel of 809,000 B. t. u. in 1926 and 705,000 B. t. u. in 1927, a decrease of approximately 13 per cent.

The Appalachian district again required a greater number of heat units per barrel of crude refined than any other district. The explanation of this fact undoubtedly lies in the large number of small refineries which were built in the days of "cheese-box" and shell stills before the present era of pipe-stills and heat exchangers; in the use for fuel of large quantities of coal, which ranks comparatively low in efficiency as used in the average Appalachian refinery; and to the fact that most of the crude processed in the Appalachian district is refined through the lubricant stage, and necessarily requires more fuel than simple skimming operations. The only district to report a higher fuel requirement per barrel in 1927 was the comparatively minor Louisiana Gulf Coast district, California and Inland Texas were the leading districts from the standpoint of low fuel requirements, due primarily to the fact that little of the crude refined in these districts was carried beyond the skimming stage, although it is suggested also that weather conditions might have been a factor.

A large part of the credit for the success attending fuel economy in 1927 may be attributed to the pipe-still. This type of equipment has been in general use for but a short time, hence its effects on fuel consumption were perhaps not widely felt prior to 1927.

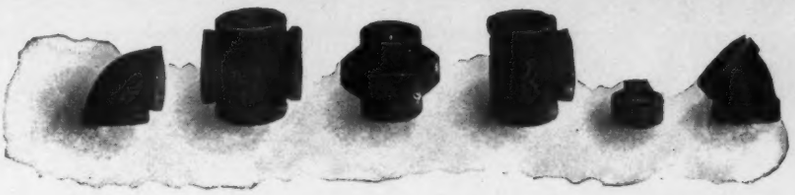
[3]The following factors were used in this calculation:

Oil	6,000,000 B. t. u. per barrel
Coal	26,000,000 B. t. u. per short ton
Gas	1,050 B. t. u. per cu. ft.
Coke	30,000,000 B. t. u. per short ton
1 kilowatt hour	3,415 B. t. u.

FUEL USED AT REFINERIES IN THE UNITED STATES, 1926-1927

	[1]Oil (Thousands of bbls.)	Coal (Thousands short tons)	Gas (Millions of cu. ft.) Natural	Refinery	Coke (Thousands of short tons)	Other	Total B.t.u. (Billions approx.)	Crude runs (Thousands of bbls.)	B.t.u. per bbl. crude run
1926									
East coast	14,701	1,447	.....	9,642	105	....	139,102	130,643	1,065,000
Appalachian	606	1,644	2,501	1,550	3	([2])	50,724	28 502	1,780 000
Indiana-Illinois, etc.	606	2,677	1	7,649	35	([3])	97,466	69,707	1,398,000
Oklahoma	2,010	6	25,957	5,425	7	....	45,377	61,409	739 000
Kansas and Missouri	2,085	226	8,048	3,478	5	....	30,638	35,097	873,000
Texas Inland	1,954	.....	3,626	537	10	....	16,395	35,183	453,000
Texas Gulf Coast	10,325	.....	25,121	12,370	127	....	105,126	119,927	877.000
Total Texas	12,279	.....	28,747	12,907	137	....	121,521	156,110	778 000
Ark.-La. Inland	50	.....	9,056	769	.....	....	10,616	19,507	544,000
La. Gulf Coast	4,808	.....	.....	3,803	101	....	35,871	51,505	696,000
Total La.-Ark.	4,858	.....	9,056	4,572	101	....	46,487	71,012	655,000
Rocky Mountain	1,496	52	30,720	4,126	15	....	47,366	29,205	1,622,000
California	5,251	.....	16,419	2,728	.....	....	51,611	197,579	261,000
Total U. S.	46,416	6,052	121,449	52,077	408	....	.....	779,264	809,000
Total B. t. u. (Billions approx.)	278,496	157,352	127,522	54,681	12,240	1	630,292	.....	.....
1927									
East coast	12,845	1,545	126	8,062	81	....	128,267	150,559	852,000
Appalachian	703	1,277	2,547	1,482	5	([4])	41,802	28,941	1,444,000
Indiana-Illinois, etc.	4,773	2,035	276	5,390	44	([5])	88 845	75,807	1,172,000
Oklahoma	2,040	6	23,630	8,018	14	....	46 047	65,699	701,000
Kansas and Missouri	2,328	121	7,398	2,074	7	....	27,270	36,172	754,000
Texas Inland	1,221	.....	4,666	1,328	8	....	13 859	37,092	374,000
Texas Gulf Coast	9,031	.....	27,338	16,042	163	....	104,625	130 003	805,000
Total Texas	10,252	.....	32,004	17,370	171	....	118 484	167 095	709,000
Ark.-La. Inland	57	.....	9,102	872	.....	....	10,815	20,031	540,000
La. Gulf Coast	2,248	.....	16,143	4,300	118	....	38,493	50,413	764,000
Total La.-Ark.	2,305	.....	25,245	5,172	118	....	49,308	70,444	700,000
Rocky Mountain	1,001	46	24,566	3,738	10	....	37,221	25 026	1,487,000
California	5,215	.....	17,831	2,159	.....	....	52,279	209,092	250,000
Total U. S.	41,462	5,031	133,623	53,465	450	....	.....	828,835	711,000
Total B. t. u. (Billions approx.)	248.772	130,806	140.304	56,138	13,500	3	589,523	.....	.....

[1]Includes acid sludge. [2]102,901 kilowatts. [3]268,240 kilowatts. [4]437,783 kilowatts. [5]482,700 kilowatts.



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HYTEMPITE is a Product of the Quigley Furnace Specialties Co., Inc.,

NEW EQUIPMENT, CATALOGS, BULLETINS, BOOKS

Improved Tube-Turns

THE PIPE BENDING PROCESS COMPANY, Inc.

The Pipe Bending Process Company, Inc., Logan Street and Goss Avenue, Louisville, Kentucky, announces a series of new and improved tube turns, short radius elbows and return bends.

The tube-turns are made by forcing lengths of seamless tubing over a horn shaped mandrel under an annealing heat. As the original tube is driven over the mandrel, the stretching action caused by the shape of the mandrel draws the excess metal away from the shortened inside wall circumferentially toward the outside wall. This eliminates buckling of the inside wall of the turn because all excess metal has been drawn toward the outside wall and is used to increase the pipe size of the tube-turn. For example: a six-inch iron pipe size tube-turn is made from a five-inch tube of the same wall thickness.

As the tube comes off the mandrel it is cut off to form the tube-turns of 180 degrees. Any other desired lengths are afterwards cut from these half-circle units. If the tube-turn is not cut off as it leaves the mandrel, a tube-turn spiral is formed.

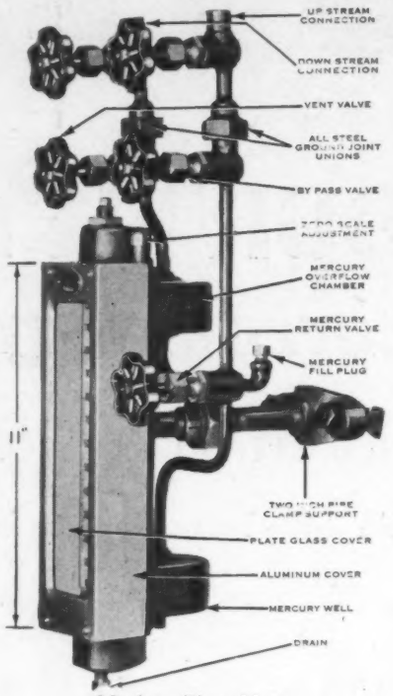
The turns are made in arcs of any number of degrees, in practically any thickness and of almost any material, such as aluminum, brass, copper, nickel, steel and special non-corrosive alloys.

The turns are manufactured to close tolerances. The allowable variation in wall thickness is plus or minus 10 per cent., the same as applies to cold-drawn seamless tubing. The tolerance in radius of turn varies from plus to zero and minus one-eighth inch on the one-inch size, to plus zero and minus one-inch on the 16-inch size.

Tube-turns can be supplied with ends rough, square or bevel cut, or flanged. Flanges can be welded on or Van Stoned. Short tangents can be provided by an additional process; long tangents can be welded on.

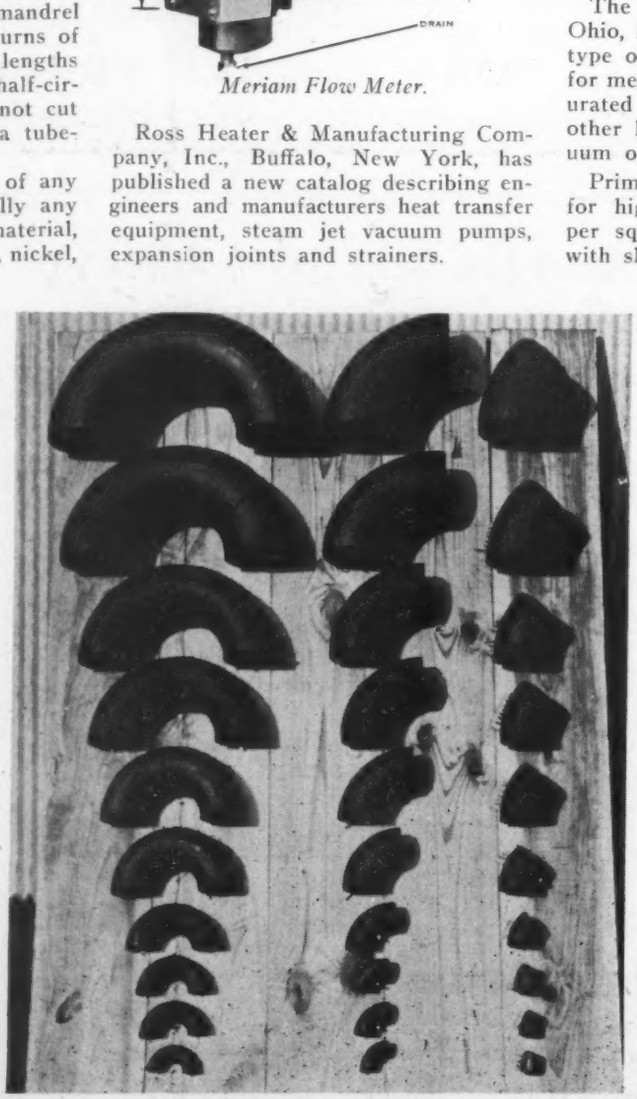
Further details may be obtained by request to the company.

The Trico Fuse Manufacturing Company, Milwaukee, has announced a new Bulletin 206-B describing Trico "Powder-Packed" Renewable Fuses. It contains interesting engineering data and tests on overload time-lag and watt loss saving. Copies may be had free on request.



Meriam Flow Meter.

Ross Heater & Manufacturing Company, Inc., Buffalo, New York, has published a new catalog describing engineers and manufacturers heat transfer equipment, steam jet vacuum pumps, expansion joints and strainers.



Improved Tube Turns.

Non-Metal Flat Arch

GEORGE P. REINTJES COMPANY

George P. Reintjes Company, 2517-19 Jefferson Street, Kansas City, Missouri, has developed a non-metal flat arch for use in furnace construction.

The flat arches are composed of only two shapes. By inverting the skew or starting brick, the key brick is obtained. The shapes are such that the arches form a natural jack arch. The arch bonds with the brickwork without excessive cutting, and by using a third shape, a trussed arch can be formed.

This flat arch is adaptable to many uses and any style of door opening can be roofed with the two shapes.

Further information is available from the company by request.

Meriam Flow Meter

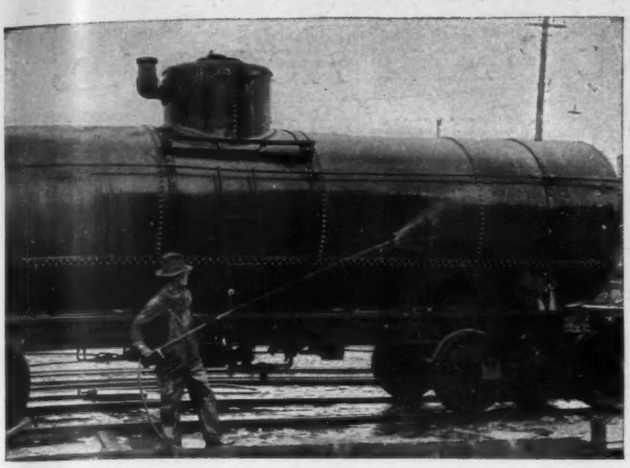
THE MERIAM COMPANY

The Merian Company, Cleveland, Ohio, has placed on the market a new type of indicating flow meter suitable for measuring the flow of air, gas, saturated or superheated steam, oils and other liquids at any temperature, vacuum or pressure.

Primarily the meters are designed for high line pressures—1000 pounds per square inch or even higher, but with slight modifications they may be used with equally satisfactory results on vacuum or on low pressures. Their operation depends upon the fact that the flow of the liquid or gas causes a loss of pressure along the pipe. To insure correct readings, an accurately-proportioned orifice-disc is placed in the path of the flow in the pipe, and two small tubes are connected to the pipe line, one on each side of the orifice disc. The difference in pressure between the two sides is recorded by the level of mercury, or other non-evaporating liquid of constant weight.

The construction of the meters presented some interesting features. In view of the very high pressures which must be dealt with in many cases, and to the inaccuracy which would be caused in the readings by even the smallest leakage under such circumstances, it was decided to weld all pipe-lines, valves, etc., in the meter connections.

Further information may be had from the company, by request.



This one-man cleaning "gang" *...washes 3 cars a day with Oakite materials*

WASHING three aluminum painted tank cars a day is only a one-man job for a certain western concern. No special equipment has been installed. A hot solution of an Oakite material is simply scrubbed in and then rinsed off with a hose. Yet, so thorough and efficient is the action of this remarkable cleaner that every bit of soot, oil and dirt is completely removed—cars dry bright and shiny without streaking.

You can make light work of cleaning tank cars, storage tanks, trucks and other equipment if you do it the Oakite way. And a regular cleaning schedule will keep them spic and span. White and aluminum painted surfaces show up like new—colors are made bright and fresh with a minimum of labor. Besides, repainting is needed less frequently.

Our booklet, "Oakite in the Oil Industry," outlines many money saving cleaning methods. Write for your copy. No obligation.

Visit us at BOOTHS No. 60. 61, 62, *Texas Bldg., International Petroleum Exposition, Tulsa, Okla., October 20 to 28.*

Manufactured only by

OAKITE PRODUCTS, INC., 50B Thames St., NEW YORK, N. Y.

Oakite Service Men, cleaning specialists, are located at

Albany, N. Y., Allentown, Pa., *Atlanta, Altoona, Pa., Baltimore, Birmingham, Ala., *Boston, Bridgeport, *Brooklyn, N. Y., Buffalo, *Camden, N. J., Canton, O., Charlotte, N. C., Chattanooga, Tenn., *Chicago, *Cincinnati, *Cleveland, *Columbus, O., *Dallas, *Davenport, *Dayton, O., *Denver, *Des Moines, *Detroit, Erie, Pa., Fall River, Mass., Flint, Mich., Fresno, Cal., *Grand Rapids, Mich., Greenville, S. C., Harrisburg, Pa., Hartford, *Houston, Texas, *Indianapolis, *Jacksonville, Fla., *Kansas City, Mo., *Los Angeles, Louisville, Ky., Madison, Wis., *Memphis, Tenn., *Milwaukee, *Minneapolis, *Moline, Ill., *Montreal, Newark, N. J., Newburgh, N. Y., New Haven, *New York, *Omaha, Neb., Oshkosh, Wis., *Oakland, Cal., *Philadelphia, Phoenix, Ariz., *Pittsburgh, Pleasantville, N. Y., Portland, Me., *Portland, Ore., Poughkeepsie, N. Y., Providence, Reading, Pa., Richmond, Va., *Rochester, N. Y., Rockford, Ill., *Rock Island, *San Francisco, *Seattle, Springfield, Mass., South Bend, Ind., *St. Louis, *St. Paul, Syracuse, N. Y., *Toledo, *Toronto, Trenton, *Tulsa, Okla., Utica, N. Y., *Vancouver, B. C., Wichita, Kan., Williamsport, Pa., Worcester, Mass.

*Stocks of Oakite materials are carried in these cities.

OAKITE

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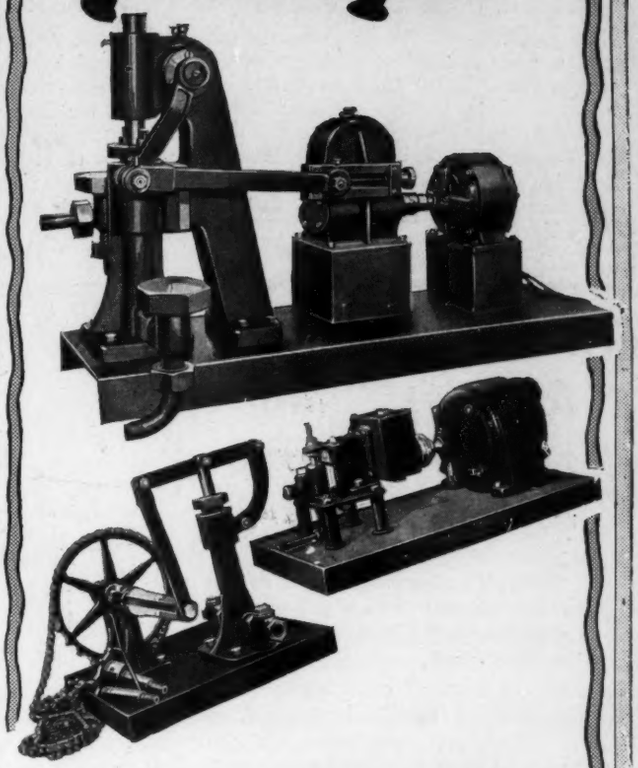
Industrial Cleaning Materials and Methods

Proportioning pumps



If each minute proportion was measured, weighed and OK'd personally, the accuracy could not be more perfect, nor the speed of the job as great as when a Hills-McCanna Proportioning Pump does the work.

For small or large quantities of treating agents, lime oil, or other liquids with solids in suspension—a battery of feeds or a single unit—Hills-McCanna Proportioning Pumps are absolutely depended upon in an uncountable number of plants and refineries.

Every treating need can be ably cared for with this equipment. Each type assures a positive feed—uninterrupted operation—freedom from over or under dosing—without labor or attention—with better accuracy and greater operating efficiency—assuring perfect control—a uniform product—greater recovery—and all around mechanical simplicity.

Positive delivery, in Hills-McCanna Proportioning Pumps, is assured by the single plunger principle. The packed stuffing boxes permit pumping against pressures without interruptions.

Hills-McCanna engineers will gladly go over your processing methods and furnish data for feeding lime-oil, caustic soda, ammonia, Tret-O-lite or other reagents with solids in suspension. Write for Proportioning Pump Bulletin R-10.

HILLS-McCANNA CO.

2349-59 NELSON ST.~ *Chicago*

THE MOST COMPLETE SERIES OF ALLOYS FOR INDUSTRIAL USE
FORCE-FEED LUBRICATORS • PROPORTIONING PUMPS • SPEED REDUCERS

REFINERY AND GASOLINE PLANT ACTIVITIES

New Plants – Construction Notes – Personnel Changes

TEXAS GASOLINE PLANT

Los Angeles—The Texas Company will build a new absorption natural gasoline plant at Santa Fe Springs, near its present plant on the Patterson lease. It will have a capacity of 40,000 gallons per day. This output added to the 15,000 gallons of the older plant, will give the company a total capacity of 55,000 gallons daily at Santa Fe Springs.

WARREN PLANT SOLD

Warren, Pa. — Negotiations have been completed by which the Swan-Finch Oil Corporation assumes ownership and operation of the Seneca Oil Works, thereby entering the gasoline refining business for the first time. The Swan-Finch Company is an old member of the Standard Oil group, and has for years been a large manufacturer and distributor of high grade lubricants, greases and compounds.

The newly acquired refinery will be operated in the future as the Swan-Finch Refining Company. It is thoroughly modern and is equipped for cracking by the Snodgrass process. Its finished products include gasoline, kerosene, light and heavy lubricating oil, paraffine and wax.

Officers of the Swan-Finch Oil Corporation include W. G. Moncrieff, president and chairman of the board, and E. V. Moncrieff, secretary and treasurer.

FORT WORTH PLANT RESUMES

Fort Worth, Texas—Plant operations were resumed early in September by the White Eagle Oil & Refining Company at its refinery, located in North Fort Worth, after being idle for more than one year because of market conditions. This plant is rated at 4000 barrels daily, and is equipped with Holmes-Manley cracking units, while the crude supply is obtained from independent producers in the North Texas district via The Texas Pipe Line Company's line. G. S. Dunham is superintendent in charge of the Fort Worth plant, with G. P. Lively as assistant.

F. P. Carroll has been made superintendent of the natural gasoline plants and oil and gas properties of the Hirt & MacDermott Interests, Fort Worth, in the Central West Texas district. Carroll makes his headquarters at Desdemona, Texas, and succeeded M. S. Eldred, who resigned to go to California.

O. P. Williams, an employe of The Texas Company at the Gates refinery, located near Dallas, Texas, was fatally burned September 7, when showered with burning oil while trying to shut off a control valve after a break developed in a flow line. The fire loss in the plant was reported as being less than $5000. Williams leaves a widow and two daughters.

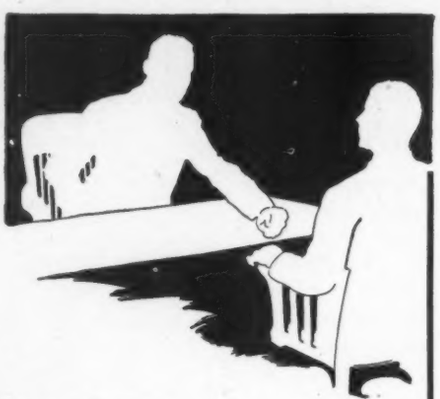
ENLARGE GASOLINE PLANT

Electra, Texas — Waggoner Refining Company has started work on enlarging the capacity of its natural gasoline plant in the South Vernon district, Wilbarger County, and will erect a new booster station in the Greyback pool. A. E. Stuart is superintendent in charge of plant operations, and is being assisted in the enlargement program by M. S. Eldred.

BIG TANKS

Dallas, Texas—The Texas Company has placed order with Reeves Brothers Company for six 120,000-barrel steel tanks to be erected at its refinery located at Gates, near Dallas. These tanks will be used for storing crude, or fuel oil, and are approximately 144 feet in diameter and 40½ feet high.

So I Said, "I'm from Missouri," and I made them prove SARCO saving.



"You know me, Bill, I've got to be shown! There's been one of those SARCO salesmen coming in here for months, trying to sell me some of those steam traps. He had it all figured out, but you know anything can look good on paper.

"Well, he came in again about two months ago with his usual story of how this self-adjusting Sarco Steam Trap would do the same work of the big traps at a third the cost and save a lot of coal, so finally I said:

"Mister, I'm from Missouri. If you're so sure those traps will cut down our fuel bill, put 'em in on demonstration.

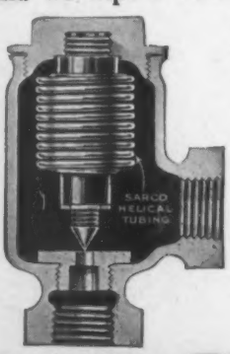
"'You're on,' he answered, and I gave him a 30-day FREE trial order.

"When they came in and I saw how small they were, and that there wasn't any bucket, or float, or valves or the other usual parts, I decided not to bother to hook 'em up. But Mike said, 'Why not try 'em anyway, so long as it's no work to just screw them into the line.' So I told him to go ahead."

"How'd they work out, Jack?"

"Why they gave me the surprise of my life. They worked O.K. and we kept a careful check on the coal used and they paid for themselves inside of six weeks as near as we can figure. They showed me, all right. If you haven't got them it will pay you to investigate."

If you're from Missouri, we'll show you, too. Write for Booklet S-286 or mail the coupon.



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30-DAY FREE TRIAL COUPON

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Kindly send me ..... ½", ¾", 1" Sarco Steam Trap for a 30-DAY FREE TRIAL. If it does not prove its value it is understood that I may return it without cost or obligation.

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"Everything for Mine and Industrial Safety"

M-S-A TANK GAUGERS MASKS

Afford Complete Protection Against Hydrogen-Sulphide Gas and Other Fumes from Sour Crudes and Distillates. Two Types Available.

Write for Bulletin No. 100

Type "C" Mask

A Canister Type Mask with single inhalation tube.

Developed especially for Tank Gaugers, Pipe Line Inspectors and Repairmen, Pumphouse Men and others who may be exposed, in unconfined places, to deadly Hydrogen Sulphide Gas from Sour Crudes and Raw Distillates. Supersize Canisters are used in all M-S-A Tank Gaugers' Masks.

Type "C" Mask in Use

M-S-A Hose Masks (Fresh Air Type) should be used in all confined spaces where Deficiency of Oxygen or High Concentrations of Petroleum Vapors may exist. Write for literature.

Manufactured only by the

Mine Safety Appliances Co.

Braddock Ave. & Thomas Blvd., Pittsburgh, Pa.

Type "D" Mask

A Canister Type Mask with double inhalation tube.

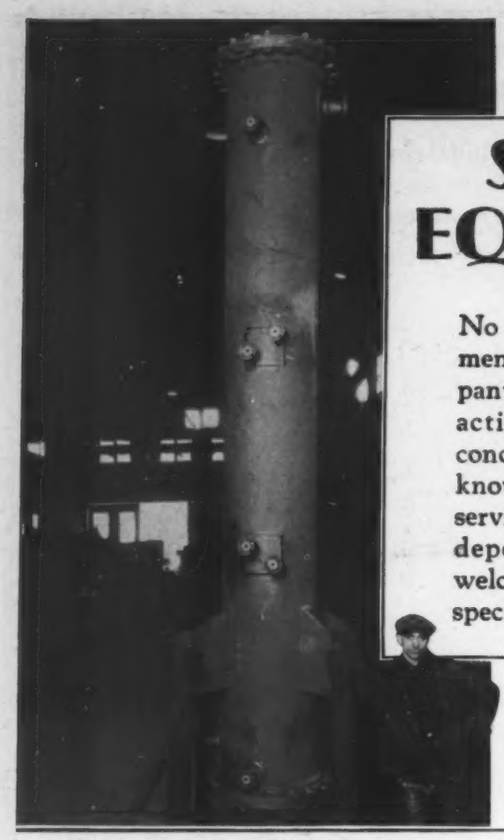
The Face Piece fastens to the two Flexible Inhalation Tubes, one over each shoulder, joining a substantial Y connection in the back between the shoulders. This arrangement assures the wearer an uninterrupted supply of air, even though one tube be temporarily closed.

De Laval Worm Gear

A Superior Speed Reducer for Vertical Shaft Drive

IN this steam plant it was convenient to use a slow speed, vertical shaft, centrifugal pump for circulating condenser water, and to locate the variable speed motor high and dry in an accessible place, by employing a De Laval 3 5/9 ratio Worm Gear. The motor develops 40 to 55 hp. at from 800 to 1600 r.p.m., the speed being varied according to the turbine load and the water temperatures.

De Laval Steam Turbine Co., Trenton, N. J.



Continuous Gasoline Treater, 22" O. D. Complete Dished Heads and Supporting Frames welded on.

SPECIAL EQUIPMENT

No matter what the requirements, Power Piping Company can meet your most exacting needs. The largest concerns in the oil industry know that "Power Piping" service is unfailing and ever dependable. Our engineers welcome consultation on any special problems.

Power Piping
FOR EVERY OIL FIELD NEED

POWER PIPING Co. PITTSBURGH

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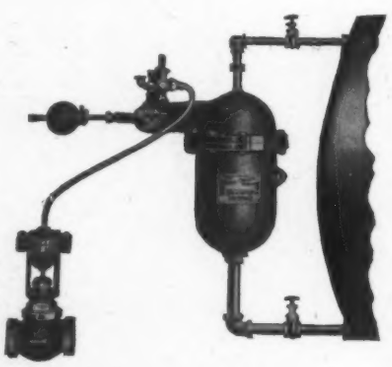
In Gasoline Recovery

THE "VIGILANT" Oil Level Regulator



In manufacturing gasoline by absorbing it in oil and then separating it from the oil by distillation, a constant oil level must be maintained in both the absorbing tank and still.

For this purpose, we offer the "Vigilant" Oil Level Regulator, adjustable to any type of absorber or steam still, which maintains a constant oil level under all conditions of temperature and pressure.

It is an Automatic Regulator of the Oil Supply in Absorber Tanks

Regulator mounted on side of tank, so that center of chamber is opposite to oil level desired.

WRITE for the Chaplin-Fulton 60-page catalog! It's free—and contains data on our many time-tested and proven gas regulators, that you will find invaluable in your work.

The Chaplin-Fulton Mfg. Co.

Organized 1884—oldest builders of gas regulators in the country. Built in all sizes, from 1-inch to 24 inches; for all service, 1 oz. up to 1,600 lbs. Pressure to square inch.

28-40 Penn Ave., Pittsburgh, Pa.

TEXAS TO BUILD FOUR REFINERIES

Four new refineries are to be built by The Texas Company and the capacity of another is to be increased.

Three of the new plants, each of 3000 barrels daily capacity, will be in Texas, one at Amarillo, one at San Antonio and the other at El Paso.

The Lockport, Illinois, plant will be enlarged so it can take care of 15,000 barrels of crude oil daily. It is now running from 5000 to 7500 barrels daily.

The fourth new plant, also of 3000 barrels capacity, will be built at Cody, Wyoming.

This expansion of refinery operation will necessitate additions to the facilities of the Texas Pipe Line Company. A line of 20,000 barrels daily capacity will be laid from Tulsa to Lockport. This will require 600 miles of new line.

Contract already has been let for a line from the West Texas area to Port Arthur for this company. The new Texas plants at Amarillo and San Antonio will be furnished crude oil through the Texas pipe line system. The El Paso plant will get raw material from some other carrier. The Cody plant will be operated on crude from the company's Oregon Basin development.

A. P. I. TANKS FOR FUEL

Houston, Texas—Humble Oil & Refining Company has purchased twelve 93,000-barrel capacity steel tanks from the Petroleum Iron Works for erection on its tank farm near the Baytown refinery, located on the Houston Ship Channel. These tanks will be made according to the American Petroleum Institute specifications, and will be used to store fuel oil.

CREDIT MEN ELECT

W. A. Ryan, credit manager of the Mid-Continent Petroleum Corporation of Tulsa, was elected chairman of the Petroleum Refiners' Division of the National Association of Credit Men in Chicago, September 4, 5 and 6. The board of trustees for the year are H. R. Wakefield, credit manager, Sun Oil Company, Philadelphia; K. R. Hawkinson, assistant treasurer, Tide Water Oil Company, New York; R. E. Holcomb, assistant treasurer, Skelly Oil Company, Tulsa; F. R. Seleine, credit manager, Shaffer Oil & Refining Company, Chicago; E. C. Claiborne, credit manager, Derby Oil Company, Wichita, Kansas, and E. F. Harrell, credit manager, Deepwater Oil Refineries, Inc., Houston.

E. B. Moran, manager of the central division of the National Association of Credit Men, was elected secretary of the refinery group.

Jenison Machinery Company of San Francisco, has acquired the good will, stocks of machinery and equipment of the Smith Booth Usher Company, also of that city. Stuart Smith has joined the Jenison Machinery Company as manager of the construction equipment division.

POSITIVE DISPLACEMENT OSCILLATING PISTON

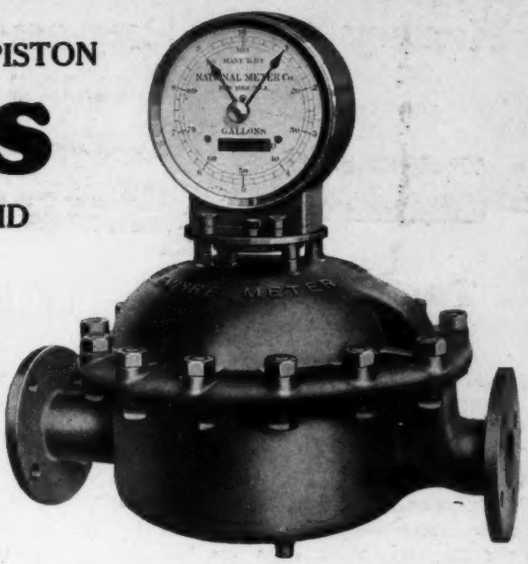
OIL METERS

FOR PETROLEUM AND ALL ITS LIQUID PRODUCTS

Entirely different from any other type of oil meter

The EMPIRE

In successful use for over forty years. Never equaled for *lasting* accuracy. Easy to install and operate. Very low in maintenance cost. Invaluable for Refinery work. All sizes from 5/8" to 6" inclusive. Made to withstand working pressures of 300 pounds to the square inch. Standard types for general use will sustain 150 pounds. Special types for still higher pressures and for special requirements.



Send for fully descriptive circular and EMPIRE information sheet, and let us make recommendations for your particular service. This is quite without obligation. Ask for Form R.

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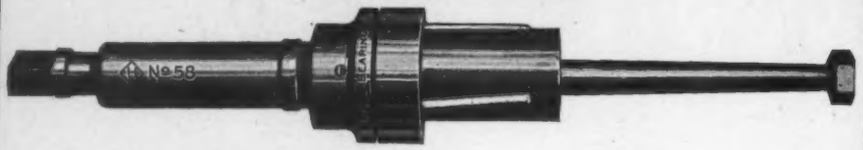
Agent for California
C. G. CLINCH & CO., SAN FRANCISCO AND SAN PEDRO

Heavy Duty Expanders for Still Tubes



Tools for the Oil Industries

Hydraulic Pressure Pumps, 8000 pounds
Tube Expanders for Cracking Still Tubes
Hydraulic Pressure Pumps, 2000 pounds
Tube Expanders for Condenser Tubes
Hydraulic Pressure Pumps, 500 pounds
Tube Expanders for Steam Boilers
Screw Punches for Structural Shapes
Tube Expanders for Pipe Work
Screw Punches for Plate Work
Flaring Tools for Still Tubes
Beading Tools for Still Tubes
Hydraulic Jacks
Hydraulic Punches

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Established 1870
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YOUR HIGH
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a distinctive color

Write us for samples of colors you wish to try

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BYRON D. DAWSON.

DAWSON WITH BURFORD

Byron D. Dawson has been selected as sales manager for the Burford Oil Company, whose new refining plant at Pecos, Texas, will be in operation in October. He is now in the headquarters office of the company in Shreveport, but after November 1 will have offices at Pecos.

Mr. Dawson was with the Amarillo Refining Company prior to the connection with the Burford Oil Company. Previously he was sales manager of the Orient Petroleum Company at Wichita Falls and later general manager of the Wichita Refining Company of that city.

A. W. Miller will serve as traffic manager for the Burford Oil Company as well as traffic manager of the Crystal Oil Refining Company of Shreveport.

F. W. Burford, vice-president and general manager of the Crystal Oil Refining Company, is president of the Burford Oil Company.

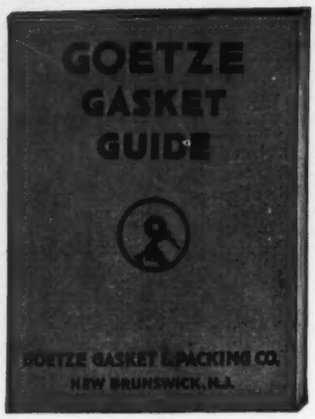
E. H. ROY MOVED

E. H. Roy has been transferred from the Gainesville, Texas, refinery of the Empire Oil & Refining Company to headquarters at Tulsa. His place as superintendent at Gainesville has been taken by C. O. Bailey, for several years superintendent of the Cushing, Oklahoma, plant. The transfer leaves Oscar Mann as acting superintendent of the Cushing refinery.

REFINERY MOVIE

Washington—The Bureau of Mines, Department of Commerce, has made arrangements with the Gulf Refining Company of Pittsburgh, Pennsylvania, for the production of an educational motion picture on the refining of petroleum. Gulf Refining Company has one of the largest and most modern petroleum refineries in the world at Port Arthur, Texas. The new picture is expected to show the latest devices and processes of refining crude oil.

GOETZE



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for
Modern Refinery Practice

Write for this 36-page "Guide"

Goetze Gasket & Packing Co.

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STRUCTURAL STEEL
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For Dependable Service call MOSHER

MOSHER *of* DALLAS
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Steel Buildings **Stills**
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Special Refinery Equipment

Tar Baby Oil Burner

Tests in leading oil refineries have proven that this burner is exceptionally efficient for burning Water Gas Tar, Fuel Oils, Acid Sludge, and Residue Fuels.

In a New Jersey plant burning 14-16 fuel oil Tar Babies have operated more than four months and are good as new. Other burners need replacement every month and must be cleaned every week.

If you want rapid ignition, complete combustion, reduced flue gas temperature, reduced upkeep cost, increased plant capacity, correct flame temperature throughout, correct flame spread, correct velocity, and high overall economy, insist on the Campbell Tar Baby Burner.

Very little steam required. Adjustable to a wide range of capacity. Simple. Easily installed.

Write for prices and discounts. Better still, send us a trial order.

Fill in, Tear off, and mail

THE CAMPBELL ENGINEERING CO., Short Hills, N. J.

Manufacturers of the Campbell Steam Flow Controller for Oil Stills and Process Systems

Without obligating us in any way, please send information on ( ) the Tar Baby Oil Burner, ( ) the Campbell Steam Flow Controller. (See February issue of this publication).

Name .....

Firm .....

Address .....

EMPIRE ADDS REFINERY

The Empire Oil & Refining Company has announced plans for building a refining plant on the Mississippi River. The new plant of 10,000 barrels capacity will be at some point above St. Louis, possibly Keokuk, Iowa. It will be served by an extension of the Empire pipe line system from Kansas. The whole venture will cost more than $10,000,000.

This new Mississippi River plant will give the Empire manufacturing outlet for its bulk and retail distributing plants in the Middle West. The purpose in selecting a river location is to utilize barge transportation where and when it is feasible.

Present Empire Oil & Refining Company plants are at Poca City, Cushing and Okmulgee, Oklahoma, and at Gainesville, Texas.

Botfield Refractories Company, Philadelphia, Pennsylvania, manufacturers of Adamant Fire Brick Cement, Adamant-Adachrome and the Adamant Gun, announces the appointment of W. E. Tierney as its representative in the South and Southwest. Mr. Tierney is a mechanical engineer and a graduate of Tulane University. His headquarters will be in New Orleans.

Los Angeles.—In accordance with a program of expansion in all its departments, producing, refining and marketing, the Western Oil & Refining Company will enlarge its refinery, and will market its products on the East Coast and increase the foreign trade.

INSTALL TOWER

Los Angeles—Boner-Sheldon have installed a fractionating tower unit for the MacMillan Petroleum Company at Long Beach. The tower has the advantage that through the patented design of its plates, it prevents return of vapor or mist to the plate above, offers perfect sealing by coalescing the oil froth, and allowing only oil rather than an oil and air-bubble mixture, to descend to the succeeding plate; and through these qualities offers a rapid and complete process, without the necessity of redistillation.

TEXAS CEMENT PLANT

Houston—The Atlas Portland Cement Company of Texas, which has just been incorporated under the laws of Texas, has completed plans for the immediate construction of a plant near Waco, Texas. It will be the first Atlas plant in the state, and will have an initial annual production of approximately one million barrels Portland cement. While the plant is being built, the company will continue to supply the trade from its mill at Independence, Kansas.

In order that the new plant at Waco may be in operation at as early a date as possible, an aggressive construction program will be pursued, according to John R. Morrow, president of the Atlas Portland Cement Company.

Announcement is made of the appointment of Roger Bowman as manager of the Cleveland office of the Merco Nordstrom Valve Company. Mr. Bowman will be in complete charge of the Cleveland territory. New offices of the Merco Nordstrom Valve Company are also being opened in Boston and Dallas, the Boston office to be located at 184 Boylston Street, and the Dallas office in the Magnolia Building.

The Union Steam Pump Company of Battle Creek, Michigan, has opened offices at 804 Second National Bank Building, Houston.

R. W. Bier is in charge of the office. Mr. Bier has a wide experience in the application of pumping units, particularly hot oil pumps.

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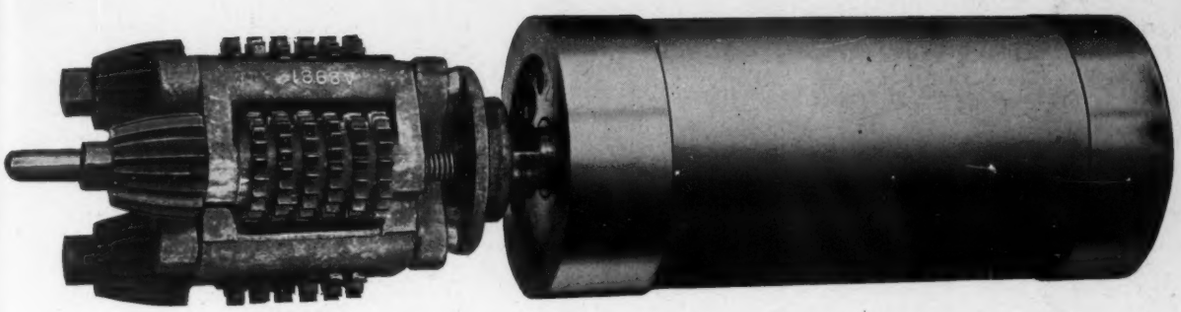

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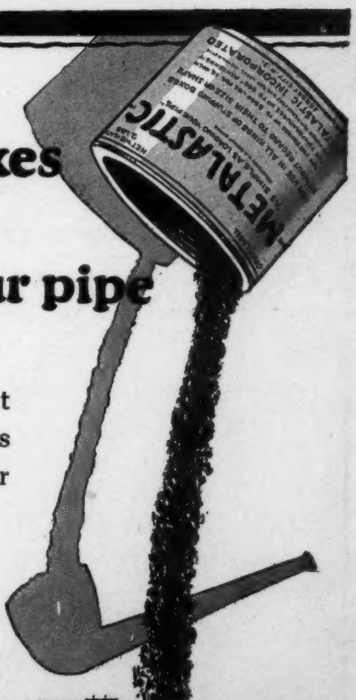

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ABSTRACTS OF TECHNICAL LITERATURE

Of Particular Interest to the Plant Operator

Better Refining Methods. Schwarz. (*Petroleum. July* 1, 1928. *pp.* 803-810. *Libr. Bull., U. O. P. Co., Vol.* 3, *No.* 29.) Attention is called to the difference between Pyhala's and Johannsen's methods of refining with the aid of soaps, and that of the author.

Pyhala's method is to treat with alkali, with acid, and again with alkali, this time mixed with naphthenic acids, with the result that the emulsifiable hydrocarbons are taken up and removed with the soaps.

Johannsen, according to United States patent 1,438,764, removes the colloidally dissolved "solids," to the presence of which is attributed the formation of stable emulsions, by aqueous soap solutions which must be sufficiently concentrated at least to wet preferentially the substances to be removed.

Schwartz, in 1922, took out German patents 403134-5 covering a process by which soaps are used instead of soap solutions. Soaps are usually formed by treating oils with alkali whether they have or have not been acid-treated; and they have an even lower surface tension with reference to the colloidally dissolved hydrocarbons to be removed than have soap solutions. The method is to treat the distillate with strong alkali and salt solutions and add soap-forming material if it is not already present. Oil-soap mixtures separate out. The impurities are thrown out with the soaps and are not found with the caustic nor in aqueous solutions nor in emulsion form. The process is in large-scale operation. It is not limited, like the other two, to emulsions or aqueous colloidal solutions.

By a proper acid treat followed by this precipitation treatment transformer oils can be produced, which are small resin formers and scarcely attack cotton at all. A turbine-oil distillate first treated with 5 per cent. sulfuric acid was then divided and part of it given the usual caustic treatment, the remainder treated by the precipitation process. The first part was found to have a tar number of 0.39, the second, 0.17. A Russian distillate, viscosity 4.5 degrees E. at 50 degrees, after being treated by the precipitation process required only 1 per cent. sulfuric acid for acid treatment, no caustic, and only 2 per cent. of bleaching earth. This gave the same color and yield as the usual treatment with 3-4 per cent. of acid followed by caustic. In cases where the stock contains no soap-forming substances and it is not practicable to add them, it is frequently an advantage to give the acid treat first, which will produce soap-forming acids, to be utilized in the precipitation treatment following. Which of several methods of procedure is best must be decided for each case by itself.

Cracking

Improved Manufacture of Cracked Benzine by the Blumner Process (*Especially from Brown-Coal Tar and Shale Oils*). *Salmony.* (*Erdol u. Teer,* 4, 91-3 (1928); *C. A. Vol.* 22, *No.* 8, *pps.* 1465-66.) A description of the commercial operation of the Blumner process in which the material is run on to molten lead and Raschig rings in cracking stills is given. Better heat distribution is obtained and local overheating is avoided by so doing. Salmony states the Blumner process results in a larger yield and output, better quality of product, less coke formation and consequently less interruption of operation than other processes; in addition, this process is applicable to all raw oils and their distillates.

Treating

New Method for Improving the Viscosines (*Cylinder Stocks*). *Gukhman.*

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(*Azerbeydj. Neft. Khoz.* 1928, *No.* 2, 61-3. *C. A., Vol.* 22, *No.* 12, *p.* 2263.) Cylinder stocks obtained from Balakhanui crude oil are called viscosines; those from Emba crude oil, vapors. Vapors have a better color (green) and are lower in carbon, 2.1-3.1 per cent. against 3.0-7.0 per cent. The viscosine was obtained after acid and caustic treatment of bottoms ("Nigrol".) The washing of this cylinder stock was very complicated because of high viscosity. Gurwitsch suggested the use of steam, which improved the quality and eliminated the treatment with caustic. The ash content dropped considerably. To obtain viscosines of higher viscosity it was necessary to distill off the lighter parts, still increasing the ash content. Pengu suggested mixing bottoms with flash 300 degree C., with one third of fuel oil to precipitate the acid sludge. To obtain heavier viscosines less distillation was necessary, cheapening the production considerably. The bottoms from Emba are treated in a solution of Solar oils. This method was used for Balakhanui bottoms on a laboratory scale. It produced a good color and lower carbon content and much less sulfuric acid was required. The proportion used was two parts by weight of bottoms with flash 305 degrees C. and one part of black Solar oil with specific gravity 0.880-0.882. Viscosity of the mixture was E100 2.7. Twelve per cent. of acid was required for treatment (on the amount of bottoms.) Treatment was carried out in two steps with 3 and 9 per cent. of acid. The temperature during the process was 20 to 25 degrees C. Loss through treatment was 36 to 37 per cent. For a cylinder stock of higher viscosity this product was partly distilled off. The distillates could be used for different lubricating oils after one or two treatments with caustic. The satisfactory results are due in great part to the low temperature used in treating the bottoms.

Physical Refining Methods of Petroleam, Tar Oil, Lubricating Oil and Paraffin. Guiselin. (*7th Congress of Technical Chemistry, Paris, Oct.* 16-22, 1927. *Zeitschr. f. angew. Chem., Dec.* 28, 1927, *p.* 1554. *Libr. Bull., U. O. P. Co., Vol.* 3, *No.* 3, *p.* 24.) At 15 degrees sulfur dioxide dissolves almost all petroleums and bitumens. If the solution is cooled, two liquid layers are formed, which differ in color and are immiscible. The lower layer consists of sulfurous acid containing in solution aromatic cyclic and naphthene hydrocarbons, oxides, sulfides, all the substances usually classed as impurities, as well as the olefins, resins, asphalts, thiophenes, pyridines, and organic acids. The whole is permeated with small quantities of paraffins. The upper layer consists mainly of paraffin hydrocarbons; the impurities disappear little by little as cooling advances. The light-oil fractions of the paraffins are especially suitable for lamps with round burner and wick, such as are used in France. It is an excellent physical process for separating the burning oils of good quality from all crude oils.

Filtration

Japanese Acid Clay. J. Soc. Chem. of Japan.) Japanese acid clay has properties analogous to those of fullers earth in England and of Florida earth in the

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United States, but it is generally believed that here (Japan) its adsorptive and decolorizaing powers are superior to both of these clays. It had long been known as Kambara earth and was found since 1899 in many places in Niigata, Fukushima, Ishikawa, and other provinces. The clay has the composition $Al_2O_3 \cdot 6SiO_2 \cdot xH_2O$, x being larger than 6, and is the decomposition product of quartz porphyry. *The powerful adsorptive and decolorizing properties are now extensively utilized in the refining of mineral and fatty oils.* The clay adsorbs caustic alkali from its aqueous solution, to which it owes its name. When an aqueous solution of a salt such as potassium chloride or of a salt of a basic dye is shaken with the clay, the basic constituent is adsorbed and the acid component is liberated. The cause of the reaction has long been discussed.

When heated with this clay, fish oil gave a mixture of liquid hydrocarbons of a petroleum nature even at atmospheric pressure. This fact was determined by K. Kobayoshi in 1920, and the result was applied to an oil industry. A similar reaction was found with various other fatty oils such as soya-bean oil, palm oil, stearine and others. Turpentine oil was found giving liquid hydrocarbons of aromatic and naphthene series, by heating with the acid clay.

The properly dried clay has a strong dehydrating action, which is manifested by the fact that ethyl alcohol is changed into ether by passing the alcoholic vapor through the clay at about 250 degrees. The dessicating action is now utilized in a commercial product named Adsol and is used for such purposes as drying air in theaters, storehouses, and other large buildings, and for drying cocoons and for their storage. *It is also used for commercial extraction of gasoline from natural gases.* A new aspect on the property of the clay is given by the discovery by T. Okazawa of the presence of an appreciable amount of rare earths in the clay. They are easily extracted by treating the clay with dilute hydrochloric acid or aqueous solution of sodium chloride, their amount ranging from 0.01 to 0.05 per cent. generally, some exceeding this. Cerium, neodymium, praseodymium, yttrium, erbium, dysprosium, and thulium were found among others.

OF PARTICULAR INTEREST TO THE REFINERY AND CHEMICAL ENGINEER

Heat Conductivity of Metals as Factor in Heat Transfer. Worthington. (*Chem. and Met. Eng., August,* 1928, *p.* 481. *Libr. Bull., U. O. P. Co., Vol.* 3, *No.* 34.) Glass, with a heat conductivity 1/300 that of copper, in condenser experiments was shown to have one-half to one-third the efficiency of copper. The heat-insulating effect of the liquid film adhering to the solid container is modified if for instance the liquid in the container is boiling. The ebullition, with production of gas bubbles, tends to disrupt the film, in addition to its stirring action. By mechanical stirring heat transfer is improved as the film is thinned. It is probable that even with heavy-gage metals, where the metal becomes a more important factor, heat-transfer differences are due to the particular character of the films formed rather than to the metals themselves. High rates of flow of cooling water in condensers are opposed to scale formation, which cuts down heat transfer, and also tend to disrupt the adherent skin on the tube. Iron boiler tubes were found in one instance to give better heat transfer when coated with carbon composition than when clean. The metals like nickel and monel metal, which are more resistant to corrosion, give the best heat exchange. Rusted, corroded, or dirty tubes are found to reduce heat transfer rates to from 75 to 35 per cent. of what the clean tubes give.

Calculation of Most Economic Insulation Thickness. Borschke. (*Archiv. fuer. Waermewirtschaft, Vol.* 9, *No.* 4, *April,* 1928, *pp.* 117-120.) Mathematical analysis, based on theory of heat transfer and using method of maxima and minima, for determination of most economic thickness of heat insulation.

Calculation of Temperature Conditions in Boiler Plants with Air Preheating. Hojer. (*Feurerungstechnick. Vol.* 19, *No.* 7, *April* 1, 1928, *pp.* 76-78. *Mech. Eng., Vol.* 50, *No.* 7, *p.* 582.) Discusses heat distribution in boilers; development of heat-balance equation in boilers with air preheating; gives example of its application by determination of flue-gas temperatures in boiler; derivation of heat-balance equation for boilers with air and water preheating.

Progress in Burning Coal. Christie. (*Power. Vol.* 67, *No.* 15, *April* 10, 1928.

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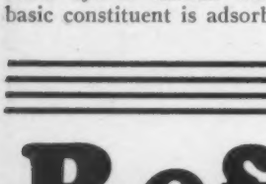

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pp. 658-660.) Recent progress may be credited to following influences: increased furnace size and better combustion; increased furnace temperatures; better appreciation of radiant heat transfer and of equipment and furnace requirements for various coals; improvements in stoker design and in powdered-coal systems; better instruments and improved furnace control.

OF PARTICULAR INTEREST TO THE CHEMIST

Testing Any Analysis

A Micro Saybolt-Type Viscosimeter. Rogers and Adkins. (*Ind. and Eng. Chem., Vol.* 20, *No.* 7, *p.* 742.) Authors describe a metal viscosimeter designed for determining the viscosity of small samples of lubricating oil, which apparatus has all the ruggedness and adaptability of the Saybolt Universal, can be made to fit into any usual form of hot or cold bath and takes as little as 8.5 ml. of sample. Its essential outside dimensions are those of the Saybolt tube, and the dimensions of the barrel are nearly proportional to the Saybolt, being 6.7 cm. high and 1.43 cm. in diameter. The outlet tube comes within the tolerances of the Saybolt Universal. When the sample available is of at least 12 ml., manipulation is according to usual practice (A. S. T. M. D88-26) except that a 10-ml. graduated cylinder is used to replace the usual 60-ml. flasks and 7 ml. are run out. If there be just sufficient sample to fill the barrel, a cover may be placed on the top of the whole apparatus and the viscosity taken after standing for a half hour or so for the sample to come to temperature. To obtain the ratio of Saybolt Universal to one of these new viscosimeters, the viscosities of a number of oil samples having a fairly wide range were determined in both instruments. From 100 to 2500 seconds Saybolt Universal this ratio varied from 4.8 to 5.1, average 4.96. The determinations were made at 77 degrees F. (25 degrees C.), to eliminate the cooling error. Other comparisons of a number of samples at 104 degrees F. (40 degrees C.), gave the same ratio, indicating that the cooling error at this temperature is less than errors of manipulation. At 210 degrees F. (98.9 degrees C.), over a range from 100 to 214 seconds Saybolt Universal, the ratio varies from 5 to 5.1, average 5.05. This higher ratio is probably due to the cooling error. As it seems to be reasonably constant, however, a closer approximation to Saybolt viscosities at 210 degrees F. (98.9 degrees C.), is possible with this instrument than with one in which the sample is kept at a constant temperature throughout. Check testing is well within the tolerances of the Saybolt Universal viscosimeter but, of course, is subject to the common manipulation errors of that instrument.

The "A" Tube—An Improved Form of "U" Tube. Jones and Hobson. (*Chem. and Ind.* 46, 52, 1,222. *J. I. P. T., Feb.* 1928.) This tube is similar to the "U" tube except that the limbs are bent so that the shoulders of the long limbs are in contact. At the base are plugs inserted in the limbs which alone are filled, leaving the cross tube empty. Serious choking is

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Temperature for Viscosity Determination. (*J. S. A. E., July,* 1928, *p.* 123. *Libr. Bull., U. O. P. Co., Vol.* 3, *No.* 31.) The Lubricants division of the S. A. E. has voted to recommend the dropping of the minimum flash and maximum pour test for transmission oils, placing transmisssion oils on the same basis as crankcase oils.

It was agreed that viscosities of transmission oils should be taken at 100° F. instead of 210° F. Transmission or rear axle lubricant temperatures are normally below 210° F. Viscosity at 100° F. more nearly indicates the behavior of the oil at lower temperatures than viscosity at 210° F. An eastern oil having a viscosity of 95 at 210° F. will at 100° F. have a viscosity of 1050; a western oil will show the respective figures 95 and 3500; at 50° F. the figures become 8500 and 100000. No such variance appears at lower temperatures between oils having the same viscosity at 100° F.

It was voted to admit Furol viscosities as well as Saybolt Universal.

The four classes of transmission oils finally agreed upon as standards are described as follows:

Viscosity No.	Viscosity range at 100° F. Saybolt Univ.	Furol
90	900-1300	90-130
120	1700-2500	170-250
160	3000-4500	300-450
200	5000-9000	500-900

Oils with viscosities falling between these ranges are to be classed in the next lower grade.

The Determination of Sulphur in Crude Petroleum and Its Products. Korsakov (*Neftyanoye Khozyaistvo* 14, 68-8 1928). *C. A., Vol.* 22, *No.* 10, *pp.* 1844-45. The usual sulfur dioxide absorption apparatus is modified as follows: The funnel has an inverted rim to catch the water condensing on the walls. This water contains up to 15 per cent of the sulfur dioxide produced. The absorption column filled with beads has on the bottom of the U-tube a stopcock to draw off the solution. The lamp has a ground-in cover and a stopper to fill the oil under test to eliminate all losses through evaporation. Titration is carried out electrometrically with a Wheatstone bridge and telephone. The container for the solution is a cylinder with a ground-in thermometer inserted through the top and reaching close to the bottom. An opening with a ground-in stopper is provided on the top to admit the liquid and reagents for titration. Two platinized platinum electrodes of 6 square centimeters each are inserted through the walls in the lower part. The temperature is kept within 0.2° and 5-6° above room temperature. Two 0.2 mm. platinum wires are led through the glass walls to connect the electrodes with the bridge. These wires are immersed in mercury containers to ensure better contact. Check analyses made with this equipment were accurate within 0.001 to 0.005 per cent.

Determination of Ammonia in Sulfonated Oils. Lang. (*Ind. and Eng. Chem., Vol.* 20, *No.* 7, *p.* 693). To the emulsion produced in a distilling flask by adding 10 to 15 grams of the oil to 50 cc. of water, add with constant shaking 100 cc. of 4 per cent sodium hydroxide solution. With continued shaking now add 100 cc. of 8 per cent calcium chloride solution. A gummy calcium soap precipitates, and the ammonia can be rapidly distilled off without any bumping or frothing into a measured portion of standard acid solution. This method yields results in close agreement with the more tedious method of shaking out an ethereal solution of the oil with successive portions of sulfuric acid as described in the works of Lewkowitsch, Holde and Mueller.

A Comparison of the Results Obtained with the Oxygen-Bomb and Carius Methods in Determining Sulfur in the Heavier Petroleum Oils. Devine and Lane. (*Bur. Mines, Reports of Investigations No.* 2866). For oils of 2.5 to 0.15 per cent. sulfur content the oxygen bomb gives consistently lower results than the Carius method. The variation amounts to 3.1 per cent for a sample of 2.47 per cent sulfur content and increases with decrease of sulfur content to 7.3 per cent for oil containing 0.15 per cent sulfur. Presence of ammonium nitrate in the bomb did not materially influence the results with the oils studied. The conclusion drawn is that the Carius method is necessary only when results of the highest accuracy are essential.

Volumetric Determination of Aromatic Hexahydrohydrocarbons in Petroleum and Tar Distillates. (*Danaila and Stoenescu. Bul. Soc. Romana Stiinte,* 29, 23 (1926). *B. C. A.-B, Feb.* 18, 1927. *p.* 98). The

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olefinic hydrocarbons are first determined in the manner described in a previous paper. The washed and dried residue is then dehydrogenated at 300-310° C. in presence of platinized asbestos. The unsaturated hydrocarbons are determined in the product as above, and again after a second dehydrogenation, and so on, until the amount of unsaturated hydrocarbons is constant. The saturated aromatic hydrocarbons are then determined. From these quantities the amount of aromatic hexahydrohydrocarbons is calculated.

Electrical Insulating Oil. Harvey. (*Elec. J.*, 25, 127-30, 1928).Harvey discusses methods of determining dielectric strength and the purification of electrical insulating oil.

Results of Research and Investigational Work

Asphaltenes and Resins in Petroleum and Petroleum Products II Neutral Resins. Sakhanov and Vassiliev. (*Petroleum Z.* 23, 1618-21 (1927); *C. A. Vol. 22, No. 8, p.* 1465). The neutral resins in petroleum are treated by treating the oil with sodium hydroxide, washing with water, precipitating out the asphaltenes with petroleum ether and removing the resins from the solution by silica gel at 50° C. The adsorbed oil is removed from the gel with benzene and the resins are obtained by washing with chloroform or a mixture of benzene with ethyl alcohol. The properties of resins obtained by this method are tabulated.

Solubility of Oxygen, Carbon Dioxide and Nitrogen in Mineral Oil; Transfer of Carbon Dioxide from Oil to Air. (*Kubie. J. Biol. Chem.*, 72, 545 (1927). *B. C. A.-B, Sept.* 2, 1927, *p.* 643.) 1 c.c. of a heavy paraffin oil dissolved 0.841 c.c. of carbon dioxide at 24-25°, 0.134 c.c. of oxygen at 28°, and 0.071 c.c. of nitrogen at 22-22.5°, at atmospheric pressure. A saturated solution of carbon dioxide in the oil, when exposed to the air, lost carbon dioxide rapidly from the upper layers, but very slowly from the lower.

Synthetic Fuels. Nash and Elvins. (*J. I. P. T., Vol.* 13, *No.* 63, *Aug.* 1927, *pp.* 597-601). Review of progress; pressure process for methyl alcohol is commercial success; it can be modified to yield liquids suitable for use as fuels, but evidence is not yet forthcoming that such modifications will be an economic success; hydrocarbon formation at atmospheric pressure holds much that is promising for future of synthetic gasoline.

Detonation Studies

Action of "Anti-knocks." (*Egerton and Gates. Nature*, 119, 427, (1927). *B. C. A-B, June* 10, 1927, *p.* 402). Antiknocks do not influence detonation in rapid-combustion mixtures; they function in the initial stages of the combustion as negative catalysts. Those metals which give effective organo-metallic antiknocks are capable of forming higher oxides. Only those types of purely organic substances are effective as antiknocks which retard the oxidation, at the ordinary temperature, of certain liquid aldehydes.

Detonation

(*Whatmough. Automobile Engineer, Vol.* 17, *Nos.* 230 *and* 231, *July and August*

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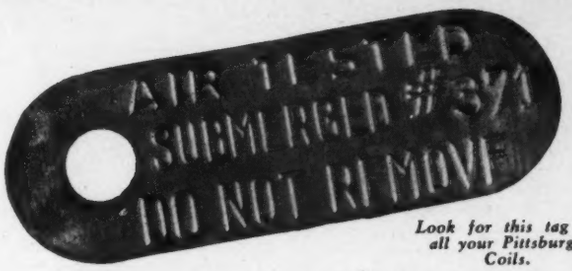

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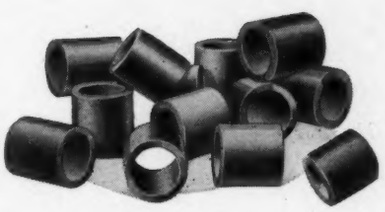

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2. There can be no clogging, choking or channeling as frequently happens with the use of coke or quartz.
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These Rings are also available in 1¼", 1½" and 2" O.D. sizes,—and are hard burned, well vitrified, non-absorbent and indestructible. They will not soften or disintegrate.

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1927, *pp.* 260-263 *and* 306-311). Radiation of energy explained. Influence of engine design.

Results of Two Detonation Surveys. Cummings. (*J. S. A. E., Vol* 22, *No.* 4, *April* 1928, *pp.* 448-457). First is survey of current methods of measuring anti-detonation qualities of motor fuels; second is survey of relative detonation characteristics of available fuels as determined by routine method of fuel testing now employed by Bureau of Standards; comparative data on apparatus and methods presented in tabulation which includes 20 laboratories; knock ratings for British and American gasolines.

Mechanical Design in Relation to Detonation. Ricardo. (*J. I. P. T., Vol.* 14, *No.* 66, *pp.* 2-10). It will not pay, at all events for automobile engines, to emplay higher compression when to do so necessitates adding any extra weight to reciprocating parts; turbulence; effect of cylinder size on detonation.

Anti-Detonators. Maxwell. (*J. I. P. T., Vol.* 13, *No.* 63, *Aug.* 1927, *pp.* 578-581). Summary of prevalent theories of pinking in internal-combustion engine.

Lubrication Studies

Lubrication and Bearing-Metal Problems in Metallurgical Works. Hopfer. (*Stahl 'u. Eisen, Vol.* 48, *No.* 13, *March* 29, 1928, *pp.* 408-10. *Mech. Eng., Vol.* 50, *No.* 7, *p.* 582). Refers to early and more recent works on development of hydrodynamic bearing friction theory, and discusses properties and suitability of different bearing alloys; claims that problem of bearing metal and lubricant can not be treated separately.

Friction Tests of Sliding Bearings. Duffing. (*V. D. I. Zeit., Vol.* 72, *No.* 15, *April* 14, 1928, *pp.* 495-499. *Mech. Eng., Vol.* 50, *No.* 7, *p.* 582). Description of testing apparatus; results of tests with liquid and semi-liquid lubricants; effect of roughness of sliding surfaces, of variation of viscosity with pressure and of nature of lubricant and sliding surface.

The Circulation System in the Oiling of Steam Turbines. (*Power House, Vol.* 22, *No.* 3, *Feb.* 5, 1928, *pp.* 31 *and* 42). Systems of lubrication decided on; individual ring-oiled bearings for small auxiliary type of turbine and improved circulation system for main units; constant circulation; needs light-bodied oil; mineral and petroleum acids; after oil is put into service in turbine circulating system, petroleum acids may be formed.

Natural Gas Industry

Natural Gas as Automobile Fuel. (*Petr. Times, Aug.* 27, 1927, *p.* 402. *Libr. Bull., U. O. P. Co., Vol* 2, *No.* 37, *pp.* 318-19). A 24-horsepower automobile truck run on natural gas was shown in Cincinnati during the convention of the Natural Gas Association in that city. It ran five hours a day during the convention, or 20 hours in all. The distance covered was 147.2 miles and the gas consumed 1461.42 cubic feet. The initial gauge pressure ranged from 198 to 225 pounds per square inch; the final, from 30.2 to 58 pounds.

The calorific value of the gas was about 1110 B. t. u. per cubic foot, or about 11,100

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Operation
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B. t. u. were required per mile. With natural gas at 75 cents per 1000 cubic foot this would mean a fuel cost of slightly over ¾ cents a mile; corresponding to about two cents for 12,600 B. t. u. from gasoline. A "Buysee" air mixer was used in place of a carburetor, and admitted 11 parts of air to one of natural gas. The tank for storing the gas under high pressure was 36 inches in diameter and 58⅝ inches long, with walls one-half inch thick. This contained 32.72 cubic feet and was mounted at the rear of the truck, lengthwise; it was intended to withstand a pressure of 200 pounds per square inch and was furnished with regulators by which pressure could be dropped from 200 pounds to 4-4½ ounces water pressure at the air mixer.

The weight and bulk of the gas container are the drawback to the use of gas as motor fuel.

The "gasol" used in Germany is held under much higher compression if not liquefied.

INCREASE CAPACITY

Houston.—The Crown Central Petroleum Corporation is renovating and enlarging its plant here, the new work including many equipment replacements and the installation of several new lubricating oil stills. The capacity of the plant will be materially increased through these improvements.

BALTIMORE PLANT ENLARGED

Baltimore.—The Prudential Refining Corporation, which was formerly named the Prudential Oil Corporation, will enlarge its refinery here, increasing the capacity from 6000 to 10,000 barrels daily.

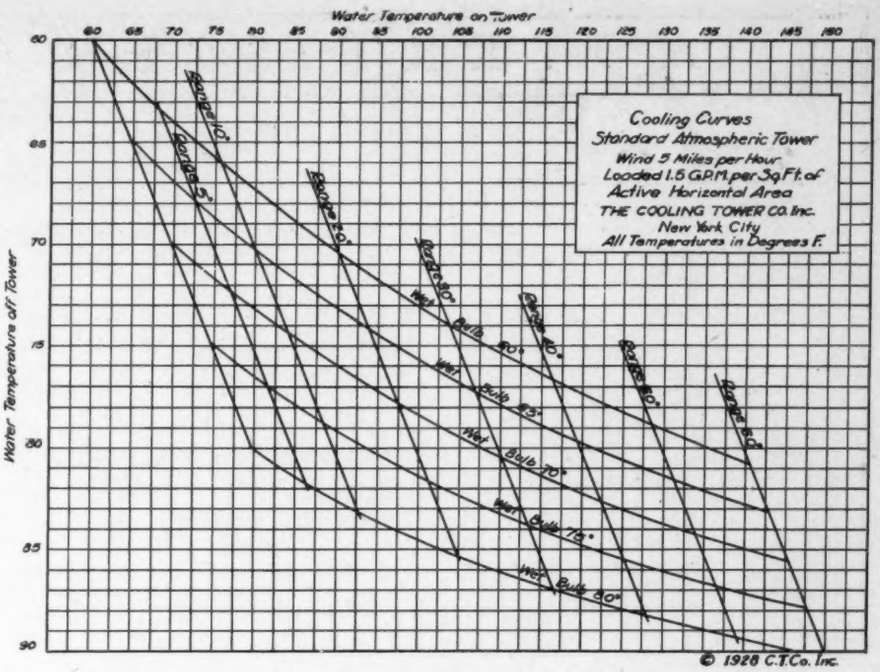
New York. — Asiatic Petroleum Company has purchased 46 acres of land at Fairfield, Maryland, and plans to spend $1,000,000 for construction there of a plant, including asphalt plant and fuel oil storage tanks.

Tulsa.—Independent Oil & Gas Company plans construction of a cracking still at its refinery at Okmulgee, Oklahoma.

Oklahoma City.—T. B. Slick Oil Company is having preliminary plans prepared for a natural gasoline plant at Maud, Oklahoma, the estimated cost being $40,000.

P. M. Raigorodsky of the Engineering, Research & Equipment Company has gone to Dallas, Texas, where he will assist J. E. Kobernik in handling the company business in the Mid-Continent and Gulf sections.

Tulsa, Okla. — Graver Corporation is reopening its Tulsa office at 810 Atlas Life building with Tom Crosby in charge, succeeding C. L. Marner who now is at Fort Worth. Mr. Crosby has been selling Graver tanks and water softeners for several years, first in Oklahoma and later in Texas.



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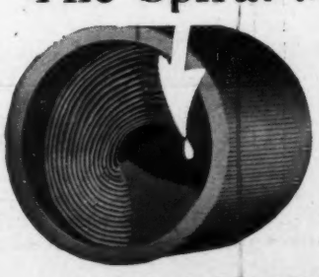
The Spiral Motion Is the Trick



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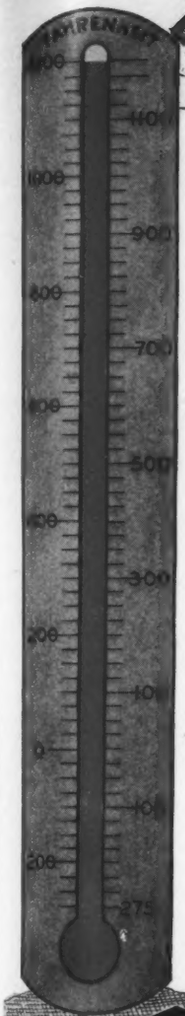

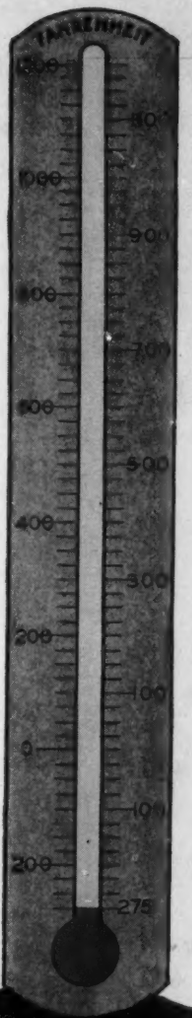

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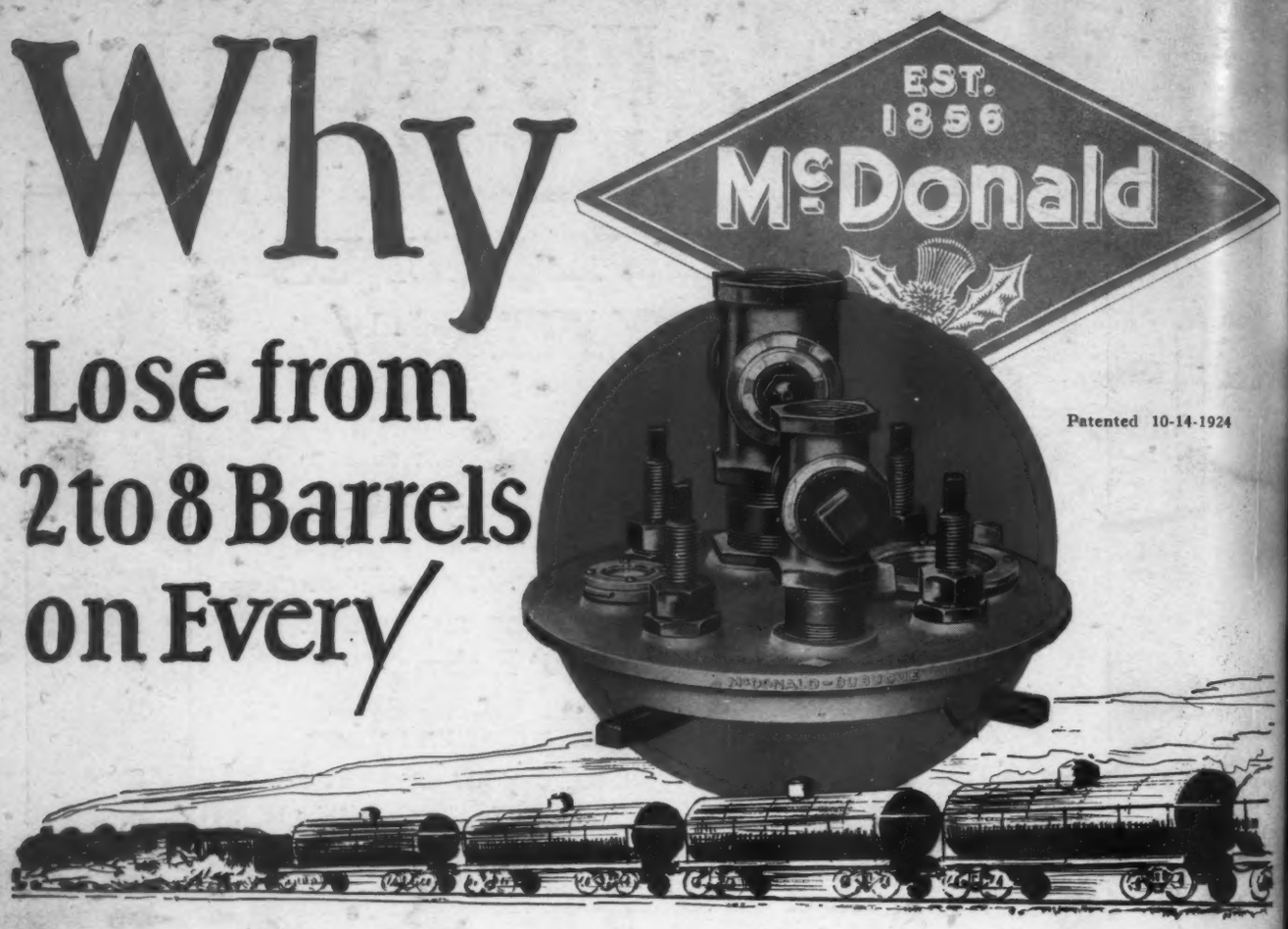

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